`

GRADUATE PROGRAM

COLLEGE OF ARCHITECTURE AND CIVIL ENGINEERING

DEPARTMENT OF CONSTRUCTION TECHNOLOGY & MANAGEMENT

PROJECT RISK MANAGEMENT PRACTICE OF OROMIA ROADS CONSTRUCTION ENTERPRISE

BY

TESHOME DEMISSE GUTA

An Independent Project Submitted to

College of Architecture and Civil Engineering for the Partial Fulfilment of the Requirements for the Degree of Masters of Engineering (MENG) in Civil Engineering: (Construction Technology and Management)

ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY

Addis Ababa, Ethiopia – December 2017

DECLARATION

I hereby declare that this independent project entitled "**Project Risk Management Practice of Oromia Roads Construction Enterprise"** was composed by myself, that the work contained herein is my own except where explicitly stated otherwise in the text, and that this work has not been submitted, in whole or in part for any other degree or professional qualification.

Name: Signature, Date

CERTIFICATE

This is to certify that the independent project prepared by **Mr.Teshome Demisse Guta** entitled "**Project Risk Management Practice of Oromia Roads Construction Enterprise"** and submitted in fulfilment of the requirements for the Degree of Master of Engineering complies with the regulation of the University and meets the accepted standards with respect to originality and quality.

APPROVED BY BOARD OF EXAMINERS

_____	_____	_____
EXAMINER (INTERNAL)	**SIGNATURE**	**DATE**
_____	_____	_____
ERA COORDINATOR	**SIGNATURE**	**DATE**
_____	_____	_____
DEPARTMENT HEAD	**SIGNATURE**	**DATE**
_____	_____	_____
COLLEGE DEAN	**SIGNATURE**	**DATE**

ACKNOWLEDGEMENTS

I would like to say thank you, to Oromia Roads Construction Enterprise Contract Administration head core work process for giving me projects data for case studies and other information used as resource for this independent project. In addition, I would like to express my gratitude to the workers of this sector, who help me carefully by answering the questionnaires and giving me full information during interviews.

I deeply appreciate my family for understanding and giving me their time during the preparation of the independent project.

Finally, great thanks to Ethiopia Roads Authority for giving me chance and making all necessary arrangement throughout my study.

ABSTRACT

The road construction industry is one of the most dynamic, risky and challenging sector. Due to construction projects complexity and uniqueness, the numbers of risk affect the project objectives through cost overruns, delays and poor quality of works. Therefore, risk management should be applied as an integral part of the project management for managing these risks in particular. The purpose of this paper is to study project risk management practice through, identifying the level of awareness of workers and using formal project risk management, and study the effect of different areas and causes in meeting project objectives of Oromia Roads Construction Enterprise. Under this study different literatures were assessed to show that project risk management is a very important management in road construction projects to meet objectives, from road project conceptualization to completion. Depending up on literature review and interviews made with construction professional workers of Oromia Roads Construction Enterprise a structured questionnaire survey was organized and three highly risk prone projects were also selected for case study. The probability of occurrence and impact of each risk on project cost, time and quality was determined using mean weighted rating. The tools used for data analysis in the study were Microsoft Excel and statistical package of social science (SPSS).The findings of this research revealed that in Oromia Roads Construction Enterprise even if there was awareness of project risk management about 84.8%, 100% no formal project risk management practice and about 90.9% clear documentation was not available. Project risk management was believed that highly important at project planning and scheduling phase in project life cycle. The methods and techniques mostly to identify, asses, allocate and mitigate the project risks were highly dependent on an individual's judgment and past experience. It was also observed that different risk areas and causes which was affect the project objectives by making cost overruns, delay and poor quality works, high risk areas revealed during assessment were inadequate site information, right of way problems, poor documentation system of risks, slow site hand over, budget constraints and ceasing of works due to rain.

Key words: Project Objectives, Projects, Risk management and Road construction

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

EPC	Engineer, Procure and Construct
ERA.	Ethiopian Roads Authority
ETB	Ethiopian Birr
FDRE	Federal Democratic Republic of Ethiopia
GC	General Contractor
ICB	International Competitive Bidding
IRM	Institute of Risk Management
LCB	Local Competitive Bidding
ORA	Oromia Roads Authority
ORCE	Oromia Roads Construction Enterprise
OWWDSE	Oromia Water Works, Design and Supervision Enterprise
PDT	Project Development Team
PMI	Project Management Institute
PPA.	Public Procurement Agency
PRMHB	Project Risk Management Hand Books
SPSS	Statistical Package of Social Science
VA	Value Analysis
VAT	Value Added Tax
WBS	Work Breakdowns Structure

CHAPTER ONE
INTRODUCTION

1.1. Background

As Fred & Scott (2012) pointed out about road construction role and highway sound effects, road constructions have played a key role in the development and sustainability of human civilization from ancient times to the present. Today, in the world, highways continue to dominate the transportation system providing critical access for the acquisition of natural resources, industrial production, and retail marketing and population mobility. The influence of highway transportation on the economic, social and political fabric of nations is far-reaching and, as a consequence, highways have been studied for decades as a cultural, political, and economic phenomenon.

Construction of roads is one of the key factors to ensure a desired level of economic growth in a developing country like Ethiopia. To bring about fast growth in any economic sector, a strong and efficient construction industry is called for, but in developing countries, the construction sector generally operates with severe limitations. Several complex activities, agencies and inputs have to interact before deriving any products or outputs of this sector. Thus, the construction industry is characterized by complex relationships between various parties which call for management system, Standard condition and Law and regulations.

Project risk management is among one of the management techniques have a significant impact to achieve a project objectives. Many construction projects do not achieve all their intended goals. Such failures could be realized in terms of severe project delay, cost overruns and poor quality. The presence of risks and uncertainties inherent in project development and implementation plays significant role in such a failure intrinsic in all stages of project (Nasirzadeh, *et al*, 2008).

According to ORCE (2017) Oromia Roads Construction Enterprise is a governmental construction firm emerged and joined the construction era in accordance with the commercial code of the Federal Democratic Republic of Ethiopia (FDRE) at 2008. The company is established with the purpose of providing various construction services and contributing to the development of the construction industry in the country. The firm is

currently registered as General Contractor (GC -1) meeting all the criteria set by government laws. The firm is also certified by the Ministry of Infrastructure construction sector and registered for VAT by Federal Inland Revenue Authority.

The number of professionals in the respective disciplines varies depending on the size, number and nature of projects at hand. However, at present the number of workers in the sector is 1163, In addition to the above employees, the organization hires and open job opportunities for day workers, at minimum of 50 daily works per each project location. The major road projects completed and delivered to client were 48 in number according to ORCE profile (2017). Currently, 17 road projects are under construction by this firm. From the date of its establishment ORCE has constructed 1,666 kilometers of all-weather roads and maintained 21,500 km roads and generated total revenue of Ethiopian Birr 4,143,473,020.00.

1.2. Statement of the Problem

Generally, the most recognized types of risk occur in roads construction are poor quality, cost overruns and delays. As Federal roads projects Getachaw (2009) ascertain that "No formal risk management system is in place to manage risks that may occur in Federal road projects" and similarly "No formal risk management plan for road projects is also required from consultants". Addis (2014) discovered "Most parties involved in Ethiopian building construction projects don't use risk management techniques in their projects that causes failure to meet their objectives". Though as clearly observed above project risk management technique is the problem of our country and that Oromia Roads Construction Enterprise is one of the regional construction sectors in Ethiopia and most of projects cost overruns and delays observed.

Project management is the application of knowledge, skills, tools and techniques to project activities to meet project objectives. Even if the problems stated above are started from the conceptualization and design stage of projects, most of problems are expected at project contracting and construction life cycle. Project risk management practice is one of the major activities of project management to overcome the problem observed. So, this study tries to investigate project risk management practice in Oromia Roads Construction Enterprise.

1.3. Objective of the research

General Objective

The main objective of the research is to study the technique of project risk management practice of Oromia Roads Construction Enterprise and to emphasize the importance of such practice in achieving project objectives.

Specific Objective

As specific objective in Oromia Roads Construction Enterprise the study is going to;

- Identify the level of awareness and use of project risk management technique.
- Study how the project risk management ranked in different construction phases.
- Study the effect of different areas and causes of risks in meeting project objectives and finally, the assessment of mitigation methods.

1.4. Research Questions

This research project will attempt to answer the following questions in order to gain an understanding of the risk management practice in Oromia Roads Construction Enterprise and the effect of different areas and causes of risks in meeting the project objectives of road construction.

- At what level project risk management awareness and formal techniques applied in Oromia Roads Construction Enterprise?
- How project risk management practice ranked in Oromia Roads Construction Enterprise depending up on construction project life cycle?
- What are the major risk areas and causes with respect to their impact on project objectives?

1.5. Significant of the Study

As the construction industry developed in Ethiopia, due to complexity of the construction the involvement of different party has to become a concerned issue, such as Owner, Contractors, financer, Engineers, Sub contractors, material suppliers, government bodies and road users. In order to meet the objectives of any project, the project management

techniques should be properly applied. This paper deals with project risk management techniques practice in road construction project as general and particularly in Oromia Roads Construction Enterprise. In addition, this study intends to provide some project risk managing frame works for the agency as a recommendation after the study and the awareness of risk management practice effect on the project delays, cost overruns and poor quality works. The study is also helpful for;

- General public influenced under the construction of roads, Oromia roads construction enterprise and other similar companies.
- Educational institution and researchers for academic purpose.
- Future studies for related topics.

1.6. Scope and limitation of study

This study was limited and focused on Oromia Roads Construction enterprise. Surveys in the forms of questionnaires, Personnel interviews and compiled data were conducted under the selected project. Since risk in construction is vast collecting all data was took long time and covering all construction projects data was difficult.

1.7. Organization of the study

The organization of the study divided in different chapters and briefly the chapter content is as following.

Chapter1. Introduction: - This section provides a background of the topic researched in this study. The main idea of this chapter is to explain the background of the problem, the objectives and the contribution made by this project.

Chapter2. Literature Review:-This chapter will provide the main subject related to the project risk management practice in construction as a general and in roads construction as detail. This chapter also overview the risk management techniques, causes, effects and also risk related other written information used for this study will be included.

Chapter3. Methodology:-This section explains research paradigm, approaches, strategies and data collection methods. In this project, a case study strategy is used to confirm or reject the propositions.

Chapter4. Case Study Analysis and Discussion:-This section provides the results from case study and comparing with the formal project risk management techniques, rules and contract documents and specifications. In addition also provides critical evaluation of this work and limitation of the study.

Chapter5. Conclusion and Recommendation:-This chapter summarizes the main issue of dissertation and overview of the result concluded from case study. It also concludes if the project meets the objectives and recommends the way of application actually on working site.

CHAPTER TWO
LITERATURE REVIEW

2.1. Introduction

PRMHB (2003) states project risk and its management as "Project risk is an uncertain event or condition that, if it occurs, has a positive or a negative effect on a project objective. A risk has a cause and, if it occurs, a consequence. Risk management is the systematic process of planning for, identifying, analyzing, responding to, controlling and monitoring project risk. It involves processes, tools, and techniques that will help the project manager maximize the probability and consequences of positive events and minimize the probability and consequences of adverse events. Project risk management is most effective when first performed early in the life of the project and is a continuing responsibility throughout the project. The project risk management process helps project sponsors and project teams to make informed decisions regarding project alternatives. Risk management encourages the project team to take appropriate measures to minimize adverse impacts to project scope, cost, and schedule including management by crisis"

According to Nael (2003), 'Construction projects are sensitive to an extremely large matrix of hazards and thus to risks. This sensitivity is due to some of the inherent characteristics of construction projects. The subject of risk, its assessment, allocation and management in construction projects should be carefully applied.'

Generally, this chapter deals with major roads construction phases, project risks, project risk management, tools, process and techniques to manage risks and other project risk related issues in detail.

2.2. Construction projects

Construction project is defined by Gene (2015) as 'an investment of scarce resource with in a definite objective, time horizon and geographical boundary.

Construction project is "an economic activity directed to the creation, renovation, repair or extension of fixed assets in the form of buildings, land improvements of an engineering nature, and other such engineering constructions as roads, bridges, dams and so forth". It is a process that consists of the building or assembling of infrastructure in the fields of architecture and civil engineering. It comprises the building of new structures, including

site preparation, as well as additions and modifications to existing ones. It also incorporates maintenance, repair, and improvements on these structures. It is the process of adding structure to real property (CDC, 2006).

2.2.1. Construction projects life cycle

Project life cycle is from its inception to closeout and termination. Risk management plays an important role in maintaining project stability and efficiency throughout the project life cycle (CDC, 2006). For most projects, different participants or parties are responsible for and control the various phases of a projects' lifecycle. According to Addis (2014) structuring distinct phases and responsibilities can increase the risk by isolating the project participants in such a manner that minimal attention is given to the overall project i.e. individual project participants become concerned with only their own project risks and either willingly or unwillingly try to transfer these risks to other project participants. There are many ways of classification method of project's lifecycle phases, from this method, Lawrence (2003) classified the project life cycle in six phases. These phases are;

I. Pre-project decision or Conceptualization phase

According to CPMHB (2007), planning the project in the initiation phase is usually the Agency's sole responsibility carried out by the Agency's project manager. However if the project is of such a size and complexity that the Agency is unsure how to plan its implementation, the Agency can retain a project management consultant during the initiation phase.

A construction project begins with an idea, a perceived need, and a desire to improve or add to productive capacity or the wish for more efficient provision of some public service. At this stage, the Owner decides what sort of project delivery system will be used. The other primary decision required by the owner early in the project relates to the type of contract to be used with the contractor (Lawrence, 2003).

II. The planning and design phase

The project is fully defined and made ready for contractor selection and deployment during the planning and design phase. The major activities in the planning phase, which require early consideration and substantive completion, are functional analysis, alternative studies, site selection, hazardous material and geotechnical studies, utility and third party coordination, environmental compliance with the National Environmental Policy and state agency (CPMHB, 2007). This phase has three stages as stated by Lawrence (2003), are shown below;

- define the projects objectives
- Consider alternative ways to attain those objectives
- Ascertain whether the project is financially feasible

Detail working drawing and design, written contract condition containing legal requirements, technical specifications stipulating of material and contractor selection is made at this stage. The phase is finalized contract with successful tenderer (Lawrence, 2003).

III. Selection of contractor

Lawrence (2003) recognized anticipation of selecting a contractor, the owner must decide whether an open invitation will be issued to all possible tenderers or whether only certain contractors will be invited to submit offers and whether any sort of pre-qualification process will be invoked to limit the number of tenders. On the other side, contractors will have to consider a number of factors in deciding whether they will make the effort to assemble a proposal for a particular project.

- First, a series of planning steps will be carried out, including studies of various methods and equipment that would be employed and the development of a preliminary project program setting forth an approximate time schedule for each major activity.
- Second, a priced proposal will be prepared, including the direct costs of labour, materials, plant and subcontractors, various overhead charges and a sufficient added amount for profit.

- The last step in this phase is the submittal, opening and evaluation of tenders, the selection of the successful contractor and the finalization of the construction contract.

IV. Contractor mobilization to construction site

After the contractor is selected, a number of activities must be completed before installation work can begin at the project site. Various bonds, licenses and insurances must be secured. A detailed program for the construction activities must be prepared. The cost estimate must be converted to a project budget and the system for tracking actual project costs must be established. The worksite must be organised, with provisions for temporary buildings and services, access and delivery, storage areas and site security. The process of obtaining materials and equipment to be incorporated into the project must be initiated and arrangements for labour, the other essential resource, must be organised. With the completion of this phase, it is finally time to begin the actual field construction (Lawrence, 2003).

V. Project Construction/Operation phase

This phase is contractor's activities on the construction site, Lawrence (2003) simply put the responsibilities involve in three basic areas. The construction phase also has the most opportunities for cost overruns due to changes and delays, disputes with contractors, and the resulting contract changes and claims (CPMHB, 2007).

A. Monitoring and control

Five aspects of monitoring and controlling the work are important.

1. Actual schedule progress must be compared against the project program to determine whether the project is on schedule; if it is not, actions must be undertaken to try to bring the program back into conformance.
2. The cost status must be checked to establish how actual performance compares with the budget.
3. Quality management, to assure that the work complies with the technical requirements set forth in the contract documents.
4. Managing the work safely and
5. Minimizes adverse environmental impacts.

B. Resource management

In managing the project's resources, the contractor will, first, be concerned with assigning and supervising personnel and assuring that the labour effort is sufficiently productive to meet schedule, cost and quality goals. In addition, materials and plant must be managed so that these same goals are met.

C. Documentation and communication

Because construction projects require large amounts of paperwork, a special effort is required to manage this documentation effectively. This documentation include working drawing, design change, payments, letters, requisitions, site survey data, test data and etc.

Chris & Stephen (2003) puts clearly that documentation might be regarded as a by-product of project risk management, rather than a central concern, but it serves a number of useful purposes that may be worth pursuing in their own right:

- **Clearer thinking: -** If people have to set down their thinking in writing, this forces clarification of what is involved.
- **Clearer communications: -** In such settings a number of questions concerning the risk management effort need to be addressed carefully in order to be acceptable between parties.
- **Familiarization: -** Documentation can provide a record to assist new project team members to 'get up to speed' quickly. Staff turnover on a project can be a significant source of risk, which documentation helps to mitigate. Risk management documentation is a very valuable training tool specific to the project to which new staffs are attached.
- **A record of decisions:-**documentation is used for rational decision during risk claims.
- **A knowledge base**: - Documentation can provide a record that captures corporate knowledge in a manner useful for subsequent similar project teams, for educational research, for competition, etc.
- **A framework for data acquisition**:-The organization having the formal risk management process should have proper and systematic data.

VI. Construction Project Termination and closeout phase

According to Lawrence (2003) finally, as the project nears completion, a number of special activities must take place before the contractor's responsibilities can be considered complete. There are various testing and startup tasks, the final cleanup, various inspections and remedial work that may result from them and the process of closing the construction office and terminating the staff's employment. In addition, a myriad of special paper work is required, including approvals and certifications that allow the contractor to receive final payment, a set of as-built drawings that include all changes made to the original design, operating manuals, warranties and a final report. The contractor will also be responsible for transferring and archiving project records and will conduct some sort of project critique and evaluation; operator training may also be part of the contractor's contractual responsibilities. According to CPMHB (2007) the project manager's responsibilities for administrative closeout relate to demobilizing the project team and completing activities with other stakeholders, arranging the disposition of project records, closing of funding and financing agreements, and performing an evaluation of project success and lessons learned.

Although, there may be some overlap in the phases, the work generally flows from the first phase to the last, with the outcome of one phase providing the basis for efforts carried out in the phase that follows.

According to Chris & Stephen (2003) phases, stages and steps in project life cycle is clearly justified as following. As it is observed below this classification is in four phases and eight stages. The breakdown into eight stages goes some way toward highlighting sources of uncertainty and facilitating their management.

Table 2.1: Phases, stages, and steps in the project life cycle

SN	Phase	Stage	Steps
1	**conceptualization**	Conceive the product	• trigger event • concept capture • clarification of purpose • concept elaboration • concept evaluation
2	**Planning**	Design the product Strategically	• basic design • development of performance criteria • design development • design evaluation
		Plan the execution strategically	• basic activity and resource-based plans • development of targets and milestones • plan development • plan evaluation
		Allocate resource tactically	• basic design and activity-based plan detail • resources development of allocation criteria • allocation development • allocation evaluation
3	**Execution**	Execution Production	• co-ordinate and control • monitor progress • modification of targets and milestones • allocation modification • control evaluation
4	**Termination**	Deliver the product	• basic deliverable verification • deliverable modification • modification of performance criteria • deliver evaluation
		Review the process	• basic review • review development • review evaluation
		Support the product	• basic maintenance and liability perception • development of support criteria • support perception development • support evaluation

(Source: project risk management process, techniques and insight book page 18)

2.2.2. Construction projects Management

The key success indicators of construction management system include completing the project with cost and time, within the planned budget and duration, and within the required quality, safety, and environmental limits (Dey, 2010). These goals are interrelated where each of them is affecting and affected by the others (Tesfaye, 2016)

Construction project should be carefully managed to achieve planned objectives Fredrick, *et al* (2011) states this idea as 'Construction project management encompasses organizing the field forces and backup personnel in administrative and engineering positions necessary for supervising labor, awarding subcontracts, purchasing materials, record keeping, and financial and other management functions to ensure profitable and timely performance of the job. The combination of managerial talents required presupposes training and experience, both in field and office operation of a construction job. Proper construction project management will spell the difference between a successful contracting organization and a failure.'

I. Principles of project managements

Whatever, the project is big or small there are a few things that must be done to achieve objectives. Depending up on project size and construction techniques common sense of project management principles are different from project to project, Yet the following are some of summarized one (Dennis, 2004).

- Knowing about the project, define it, find out exactly what to be done, know which jobs needs pay and which one is the other responsibility and are there any special conditions and finally prepare check list.
- Estimating the cost accurately using latest technology
- Allowing estimated cost for contingencies, provisional items and price escalation.
- Knowing about customers about payment system
- Knowing that is the contract understood and agreed by all parties? Knowing some standards used to remove misunderstanding and reduce claim cost.
- Checking cash flow whether it is enough to continue work progress or not, if any payment from client is delayed.
- formal planning

- Know how to measure work done against plan and be prepared to take action as soon as notice things starting to go wrong.
- Control changes in requested by customer. Are changes occurred in variation order range? So, work measurement is a good way to ask customer.
- Take steps to keep inconvenience to the public at a minimum.
- Pay regard to health and safety.
- Think about site security.

According to Chris & Stephen (2003) documentation is a key feature of all formal processes. All project managers are aware of the importance of documentation for effective project management. Especially important because of the need to deal with uncertainty in terms of both variability and ambiguity

Asking for professional help from the architect, surveyor, lawyer, accountant, tax expert and so on is good, so that potential problems get nipped in the bud. This may save projects from tripping over some of the red tape that seems to be everywhere these days (PMI, 2000).

2.3. Road Construction Projects

According to Abraham (2008) construction road project can be defined as a linear repetitive engineered construction project requiring an external organization for its implementation and is a temporary endeavor undertaken to produce a unique product, the road infrastructure.

According to Emeritus & O'Flaherty (2002) the location of a new major road can require consideration of many complex and interrelated factors, which normally utilize the skills of economists, geologists, planners and surveyors as well as those of road engineers. Before attempting to define the physical location of a new road data must be available to the road engineer regarding traffic volumes and desires, the planning intentions within the area to be traversed and preliminary estimates of the anticipated design of the proposed road.

2.3.1. Road construction organization system

Richard & Bent (2004) organize the road works in the following ways. These include new construction, renewals (overlays, pavement reconstruction and rehabilitation),

maintenance works like routine and periodic and operation or road network management. Similarly, ERA (2013) puts classification and justifications as following:

- **New construction** is the construction of a pavement system on a new alignment that has not been previously constructed.
- **Rehabilitation** is defined as the repair and upgrading of an existing pavement. Typically, this involves the repair or removal of and construction of additional bound pavement layers and could include partial depth or full-depth recycling or reclamation.
- **Re-construction** including upgrading is defined as complete removal of an existing pavement system typically down to and including the upper portion of the foundation soil and the replacement with a new pavement structure.

2.3.2. Road construction procurement

Richard & Bent (2004) also puts a number of different procurement options exist that can be used for these. The most common options grouped according to them are as follows:

I. In-house (Force Account or Direct labour)

All aspects of planning and execution of an infrastructure project are handled exclusively by one party. Normally a branch office of government department is common. Richard & Bent (2004) also puts clearly the advantage and disadvantage of force account procurement.

Advantage

- The design, construction and supervision are handled by the owner's organization,
- Disagreement with other parties does not occur, and the personnel involved are familiar with the requirements, policies and procedures related to the project.
- Possible to save time.

Disadvantage

- Internal cost control is often inadequate, and this tends to result in higher overall project costs than for other project execution methods.
- There is also a tendency towards lax quality control (why check oneself).

- Difficult to hold anyone accountable for delays and poor quality works.
- There is often a reluctance to replace poor quality works because of the additional costs involved.
- Work is often implemented in a manner that makes use of available resources (work force, equipment and materials), rather than applying rational and efficient work methods.

II. Agency Agreements

An agency is an organization with delegated authority from the road owner for operation and management of part of the network. Traditionally, agencies have been local authorities that manage part of the road network on behalf of the national road administration. Agencies have, in the past, operated under a framework agreement that sets out activities to be performed, but with considerable discretion to undertake work as they consider appropriate. Typically, activities have included designing, supervising and managing maintenance, improvement works and winter maintenance, and ensuring that the network is maintained to national standards. More recently, agency agreements have moved towards performance-based agreements, rather than simply listing activities to be undertaken (Richard & Bent, 2004)

III. Contract

A. Works and Supervision contracts

For most project execution methods, with the exception of in-house execution, projects will be constructed under a formal agreement known as a 'contract'. Under a contract system, the employer enters into an agreement with a contractor, who is often chosen through competitive tendering from a number of bidders. When the process is open to competition from any company, irrespective of their country of origin, this procurement process is often referred to as 'international competitive bidding' (ICB). When competition is restricted to local firms, then the process is known as 'local competitive bidding' (LCB).

According to Richard & Bent (2004), to assist in project administration and to supervise the work of the contractor, it is common for the owner to appoint a firm of consulting engineers in some cases the same firm that designed the project. One advantage of the construction contract is that responsibilities between the three parties (the employer, the

contractor and the engineer) are well defined Competitive procurement of road works contracts stimulates efficiency and obtains the lowest possible price for a project. The detailed tender documents for these contracts need to include all details about the design, so the method enables fair competition between potential contractors. The owner benefits by knowing the financial obligation before commencement of works. The drawback of works contracts is that procurement tends to be more time consuming than other project implementation methods because of the need for the detailed design to be substantially complete. On the other hand, time extensions, claims and the like are safeguarded as a result of the meticulous preparation.

B. EPC contracts

In an 'engineer, procure and construct' (EPC) contract, the employer enters into a contract with a single company or entity for both design and construction of the complete project. This is often done on the basis of a fixed price. This type of contract is also known as 'design and build' or 'turnkey'.

Advantages

- The employer has to deal with only one party, who is responsible for all aspects of the works.
- Total project costs will be known before a final decision is made to go ahead with the scheme.
- It is also possible for the works to be started before design has been finalized, which may advance project completion and bring earlier benefits to the employer.

Disadvantages

- It can often be complicated to define the terms or content of these projects.
- This means that it may be difficult to select a company on a competitive basis, as the various companies may offer widely differing terms and conditions.
- Errors are not easily detected and the employer has less influence on project matters than for other project execution methods.

The EPC solution is best suited for projects that are relatively straightforward and well defined. The approach is used widely for projects where specialized expertise is held by a few organizations.

IV. Concession

A road concession is the award of a right or a license to build, own and operate a road for a given period of time. Concessions are awarded to private sector companies to develop and implement a road project, and then operate it long enough to pay back the investment. The road is then normally transferred back to the host government. Concession companies may include private-sector financiers, international contractors, suppliers and other interested parties together with local partners, including government agencies.

Different terminology is used for concessions. The term BOT stands for 'build, own and transfer' or 'build, operate and transfer'. Other terms in common use include BOOT 'build, own, operate and transfer', BOO 'build, own and operate', BOOST 'build, own, operate, subsidize and transfer', BLT 'build, lease and transfer' and DBFO 'design, build, finance and operate'. All are types of concessions, and all require the provision of private capital to finance the works. Richard & Bent (2004) puts the advantage and disadvantages as following:

Advantage

- Concessions offer an opportunity for developing and emerging countries to expand their infrastructure without having to finance the construction out of the national budget or through development assistance.
- Costs are repaid through fees paid by users of the road, normally through tolls. Other forms of 'shadow' financing are now also used.
- Projects tend to be implemented more quickly than through the public sector.
- Risk is passed to the private sector, whose are better able to manage it than governments.
- There is an incentive for efficient and innovative construction.

Disadvantages

- The opportunities that concessions offer to developing or emerging nations, there is a need to put in place laws and rules that regulate the toll-fees, establish procedures for toll-fee adjustments, and determine the required service level for the road.
- Investors are often unwilling to finance road projects, since returns on investment can be marginal and risks high because return periods are long. There is normally a requirement for specific guarantees to be given by governments, often relating to guaranteed minimum toll revenues. Thus, concessions tend to be complex, time and effort consuming, costly to develop and risky.

V. External financing

According to Lawrence (2003), the execution of infrastructure projects in developing and emerging countries is often undertaken with some degree of external financial assistance. This assistance may be used for the design and/or the supervision of the works (consultants), the construction of the works (contractors) or a combination thereof. The involvement of external finance is often requested by the employer (owner), being a branch office of a national road authority or municipality. However, international aid and lending agencies often require the involvement of consultants and contractors appointed under ICB, and the application of strict procedures to ensure that the procurement is effective, and meets international standards in terms of efficiency, equal opportunity for bidders and fairness and transparency of the procurement process.

2.3.3. Roads construction delivery system

Lawrence (2003) describes as the 'eternal triangle' of construction consists of the owner, designer and construction organisation. All project delivery systems include these three as participants; with others often part of the project team as well. Their relationships vary according to the different systems and ownerships. This section describes several ways in which the various parties involved in the construction contract can be related.

I. Traditional design-tender-build

According to Lawrence (2003) because this approach is used for many centuries it is called ‘traditional’. The owner contracts with a design organisation to perform preliminary planning, carryout design work and prepare contract documents. Following the completion of this phase, a construction organisation is selected, based upon the owner’s criteria, and the owner enters into a contract with the successful contractor for the assembly of the project elements in the field. In this method, the contract for the design work is separate from that for the construction work. Note that the owner is under contractual obligation to two parties: the design professional to prepare the design and the general contractor to carry out the field installation. Each of these two parties typically has its own contracts with various sub-consultants and sub-contractors. Design and construction are separated and the sequence is sometimes time consuming.

II. Design-Build

The distinguishing characteristic of the design–build, or design–construct, method is that the owner executes a single contract with an organisation that becomes responsible for both the design and the construction of the project. Cost, schedule and quality can be clearly defined and appropriately balanced. The design–build organisation will manage many of the risks that the owner might otherwise be responsible for (Zewudu, 2012).

III. Build-Own-Operate-Transfer (BOOT)

BOOT is type of project has evolved as a means of involving the private sector in the development of the public infrastructure. The concept, in use in some parts of the world for some centuries, requires the private sector to finance, design, build, operate and manage the facility and then transfer the asset to the government free of charge after a specified concession period (Zewudu, 2012).

2.3.4. Oromia Roads Construction Enterprise

Oromia Roads Construction Enterprise is the regional construction sector found in Ethiopia and most of the projects cost overrun and project delay is observed. The sample projects data shows cost overruns and project delays when compared with the amount of contract and time to complete the projects are clearly observed below at Table 2.2. As data

collected from Contract Administration Core Work Process of Oromia Roads Construction Enterprise (2017), the time extension asked for the sample projects are all most comparable problems like due to rainy weather, fuel shortage, delay requested payments for executed and approved works, design problems, right of way problems, additional work order, budget constraint etc., similarly cost overruns of these projects are due to absence of items in contract documents, fixing of new rates, the volume of actual works are not similar with the volume found in design and etc.

Table 2.2. Examples of sample projects cost overruns and project delays

S.N	**Project Name**	**Project Location**	**Contract Duration (in days)**	**Completion period/time extended (in days)**	**Difference days**	**(%) time overlaps**	**Project contract cost (in 000'birr)**	**Project Completion Cost /Amendment cost (in 000'birr)**	**Difference in cost (in 000' birr)**	**(%) cost overruns**	**Current status**
1.	Ejersa –Goro-Cinaksan	East Hararge	560	2165	1605	100+	92,948.94	279,865.32	290,757.49	100+	completed
2.	Cira -Anfalo	Jima	1440	2531 at 25/10/2017	1091 exceed	76	129,875.72	259,054.617	129,178.90	99	On progress
3.	Kurbi-Kiwi-Dado	East Hararge	560	2569 at 25/10/2017	2009 exceed	100+	215,542.41	303,125.06	87,582.65	41	On progress
4.	Shenan-Godara-Babich	West Shewa	1095	2114	1000	91	100,013.02	124,521.56	24,508.54	25	completed
5.	Welel-Nunu	Kelam Wollega	690	2571 at 25/10/2017	1881 exceed	100+	416,426.89	453,445.16	37,018.27	9	On progress
6.	Bege-Keta	Jima	1095	1770	675 exceed	35	137,448.42	374,185.48	209,737.54	100+	On progress
7	Kono-Dogoma-Kibi	West Shewa	1095	2569 at 25/10/2017	1474 (exceed)	100+	118,898.18	175,371.15	56,472.97	47	On progress
8	Kercha-Shakiso	Guji	1460	2550 at 25/10/2017	1090 (exceed)	75	319,478.85	685,623.34	367,400.68	100+	On progress
9	Shakiso –Boke-Haranfama	Guji	790	2579 at 25/10/2017	1789 (exceed)	100+	116,275.6	239,392.41	123,116.81	100+	On progress
10	Harbu Senta-Tulu Wayu	Horo-Guduru	330	651	321	97	31,491.06	42,403.89	10,912.83	35	Completed

(Source:-Compiled from Oromia Roads Construction Contract administration work core process report, 2017)

2.4. Project Risks

Risk can be defined as the combination of the probability of an event and its consequences according to IRM (2002) and also defined by Stefano (2008) as an intrinsic element of a project, and the more the latter is innovative, the greater the risk. A project without a risk factor is not a project. Moreover, since its success depends greatly on its degree of innovation, the ability to manage risk is one of the most qualifying skills required when working on projects.

A risk may have one or more causes and the cause may be a requirement, assumption, constraint, or condition that creates the possibility of negative or positive outcomes (PMI, 2008).

2.4.1. Project risk Assessment

According to IRM (2002), the two most important factors involved in risk assessment are the likelihood of the risk occurrence and the size of its consequence if it occurs. If a risk is very unlikely to occur and if its consequence is minor then it's of less importance to the parties involved. On the other hand if the risk is likely to occur and cause major consequences, then the risk is of major concern to everyone involved. In some circumstances a party may prefer to walk away from the project rather than assume such a risk.

According to Francis (2008), the different techniques that are used to assess the likelihood of the risk occurrence are quantitative probability assessments based on historical data; subjective probability assessments based on expert judgment. A conventional risk analysis can be used based on experience to rank the importance of the risks in descending order from high risk to low risk. A risk ranking matrix, as shown in the Figure 2.1, can be used for categorizing the risk as minor, moderate or major and decide on the action to be taken. Minor risks can be accepted, moderate risks need some management measures and for major risks with high probability of occurrence and high impact a serious risk action schedule needs to be devised to manage the risk. If the risk is too big, the party might decide to walk away from the project instead of assuming it.

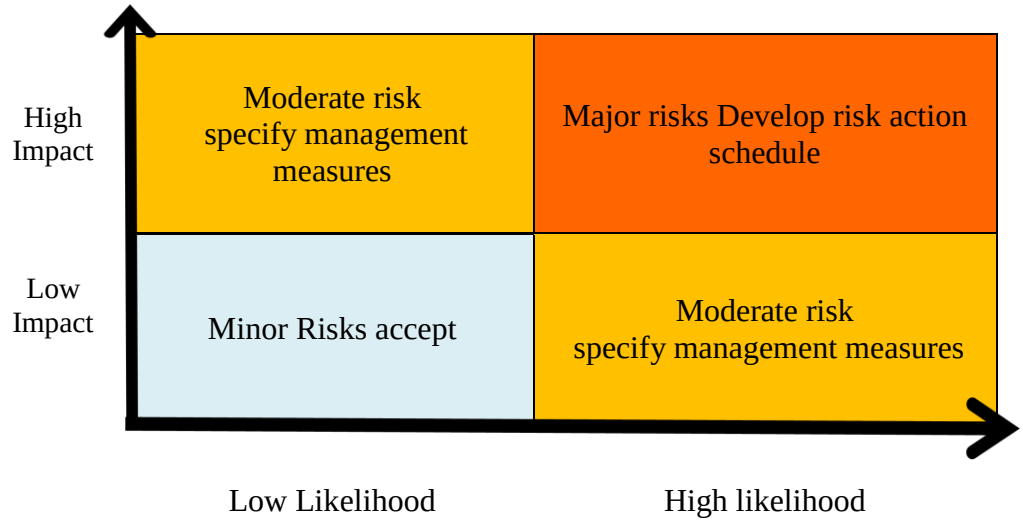

Fig. 2.1: Project risk ranking matrix (Source: Risk management guide line, 2004)

2.5. Road Construction Related Project Risks

If the Public Body deems it to be appropriate, it may hold a Pre-Bid Conference for prospective Bidders who received a Bidding Documents for clarification and discussion on the Bidding Documents or modification thereto. The Public Body may also organize a site visit or visits concurrently with the Pre-Bid Conference to allow Bidders to visit and examine the site or sites and obtain for itself, at its own responsibility and risk, all information that may be necessary for preparing the bid and entering into the Contract. The costs of visiting the site or sites shall be at the Bidder's own expense (PPA, 2011).

2.5.1. Natural related risks arising during construction

Natural risks are severe and extreme weather, climate events and other natural disasters happened during construction. Although they occur in all parts of the world, some regions are more vulnerable to certain hazards than others. Some of natural related risk areas include unexpected flood, unexpected landslides and ceasing of construction works due to rain (PRMHB, 2003).

2.5.2. Physical related risks arising during construction

Physical risk in constructions is risks that normally deal with physical nature of the project. This type of risk cannot be controlled by any means, frequent damage of equipment, labor injuries at construction site, theft of construction material, shortage of plant and equipment, unskilled labour for equipment maintenance etc. There can also be

some unexpected or unforeseen event that can occur on the construction site (PRMHB, 2003).

2.5.3. Financial and economic related risks arising during construction

Jayasudha and Vidivelli (2016) financial related risk areas involves issues or concerns associated with the financing of the project, including the execution period and operations or equity financing while economic risk factor involves issues or concerns associated with the macroeconomic impact of the project to the community and region within which it is to be located.

2.5.4. Political and environmental related risks arising during construction

According to Jayasudha and Vidivelli (2016) the environmental risks of the project are factor involves issues or concerns associated with the environmental problems, concerns, and activities confronting the project during the project execution and the project operation. This risk factor involves issues or concerns associated with the local, regional, and national political and regulatory situation confronting the project.

2.5.5. Design related risks arising during construction

Many construction problems are due to design defects and can be traced back to the design process. As Getachew (2009), the study reported that "approximately half of all construction contract modifications can be attributed to design deficiencies." The study further defined a design deficiency as "Any deficiency in the drawings and or specifications which results in the facility which would not adequately perform its intended mission."

2.5.6. Construction related risks arising during execution

According to PMI (2004) construction projects can be identified as two main phases which are project development phase and project implementation phases. These two can be further detailed and developed into larger number of phases, e.g. feasibility, design, procurement, construction commissioning and operation. Due to their dynamic nature, projects change continuously. Thus a great amount of risk and uncertainty is involved in construction activities (Chapman and Ward, 2004).

2.5.7. Contractual risks arising during construction

The delivery system selected for a project, and the contract structure reflecting that system, can greatly affect the risk of conflicts regarding such fundamental issues as scope, time, money and risk allocation (Chapman and Ward, 2004).

Most standard conditions of contract apportion the normal risks of construction to the party best able to control the risk. The apportionment will vary from form to form but many have been agreed within the industry as giving a reasonable balance between employer and contractor and it is generally unwise to upset this for normal types of civil engineering work (Twort & Gordon, 2004)

Among the most common risks encountered during the construction of a project by a civil engineering contractor under a standard type of construction contract, are the following:

- Design errors, quantification errors.
- Design changes found necessary, or required by the employer.
- Unforeseen physical conditions or artificial obstructions.
- Unforeseen price rises in labour, materials or plant.
- Theft or damage to the works, or materials and equipment on site.
- Weather conditions, including floods or excessive hot weather.
- Delay or inability to obtain materials or equipment required.
- Inability to get the amount or quality of labour required, or labour strikes.
- Errors in pricing by the contractor.

2.5.8. Project management related risks arising during construction

According to PMI (2004) project risk management is often perceived as specialist activity under taken by experts using dedicated tools and techniques in order to allow project teams and the overall organization to gain the full benefits from implementing the risks process, it is important that risk management should become fully integrated in to both the management of the projects and in to organizational cultures. So, risk areas related to project management arising during construction are risks occurred due to improper project management and may cause the project objective failures.

2.6. Project Risk Management

The construction industry and its parties are associated with a high degree of risk due to the nature of construction business activities, processes, environment, and organization. Risk in construction has been the object of attention because of time and cost overruns associated with construction projects (Mahamid, 2014).

Nael (2003) define risk management as concerned with the mitigation of those risks deriving from unavoidable hazards through the optimum specification of warning and safety devices; and risk control procedures, such as contingency plans and emergency actions. Also according to (IRM, 2002), it is the process whereby organizations methodically address the risks attaching to their activities with the goal of achieving sustained benefit within each activity and across the portfolio of all activities.

The definition of Project risk management in (PMI, 2008), "Project Risk Management includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project."

If a decision is made to accept a risk, a further decision must be made on whether the risk should be retained or whether it should be shared and if so with whom. Before such decisions can be made, it is necessary to go through a systematic process, which involves the analysis of the possible hazards to which the project may be exposed and the evaluation of their intensity, frequency and return period (Nael, 2003).

There are many source of uncertainty in construction projects Stefano (2008) said that in a project, the sources of uncertainty can arise from the following areas:

- Identification of the customer's needs
- Knowledge and management of technology
- Behavior of the competitors
- Type and availability of the resources

These sources of uncertainty determine the so-called risk areas, which can be defined as those factors that are not fully dependent on project choices, in other words, that cannot be completely controlled or predicted, but that may have a great impact on the project and its performances, namely the following:

- Time – namely the duration of each activity and therefore, that of the entire project
- Costs – meaning both the cost of the resources and their exploitation rate
- Quality of the project's outputs (or deliverables)

According to Jason (2006), the risk management process is terminated only when the project execution phase is complete.

2.7. A systematic Approach to Project Risk Management Techniques

The systematic approach makes the risks clear, formally describing them and making them easier to manage. In other words, systematic risk management is a management tool, which requires practical experience and training in the use of the techniques (Anthony, 2014).

According to Godfrey (1996), systematic risk management helps to;

- Identify, assess, and rank risks, making the risks explicit;
- Focus on the major risks of the project;
- Make informed decision on the provision for adversity, e.g. mitigation measures;
- Minimize potential damage should the worst happen;
- Control the uncertain aspects of construction projects;
- Clarify and formalize the company's role and the roles of others in the risk management process;
- Identify the opportunities to enhance project performance

Risk management can be approached in two ways reactive and proactive approaches.

Reactive Approach

According to PRMHB (2003) reactive risk management approach kicks in to action once an accident happens, or problems are identified after the audit. The accident is investigated, and measures are taken to avoid similar events happening in the future. Further measures will be taken to reduce the negative impact. The incident could cause on business profitability and sustainability. Using this method project risk might be:

- Manage risk
- Correct mistakes

- Compensate the negative effect that have occurred

Proactive Approach

Proactive approach is adaptive, closed loop feedback control strategy based on measurement observation of the present safety level and planned explicit target safety level with creative intellectuality. Attempt to reduce the tendency of any accident happening in future by identifying the boundaries of activities, where, a breach of boundaries can lead to an accident.

Proactive approach required to risk management in all aspects of organization wide understanding of activities, roles and responsibilities for risk management (PRMHB, 2003).

PMI (2000), states that proactive approach is to:

- Identify and manage risks, so as to avoid the onset of problems
- Eliminate the causes of risk at the root, acting on the risk factors

Since risk factors are an intrinsic feature of the projects, a proactive approach will attempt to prevent, rather than simply eliminate, risk. Five stages can be defined as follows:

Risk management is a systematic process used to maximize the probability and consequences of positive events and minimizing the probability and consequence of adverse events to project objectives (PMI, 2000). This book also suggests that the following major processes.

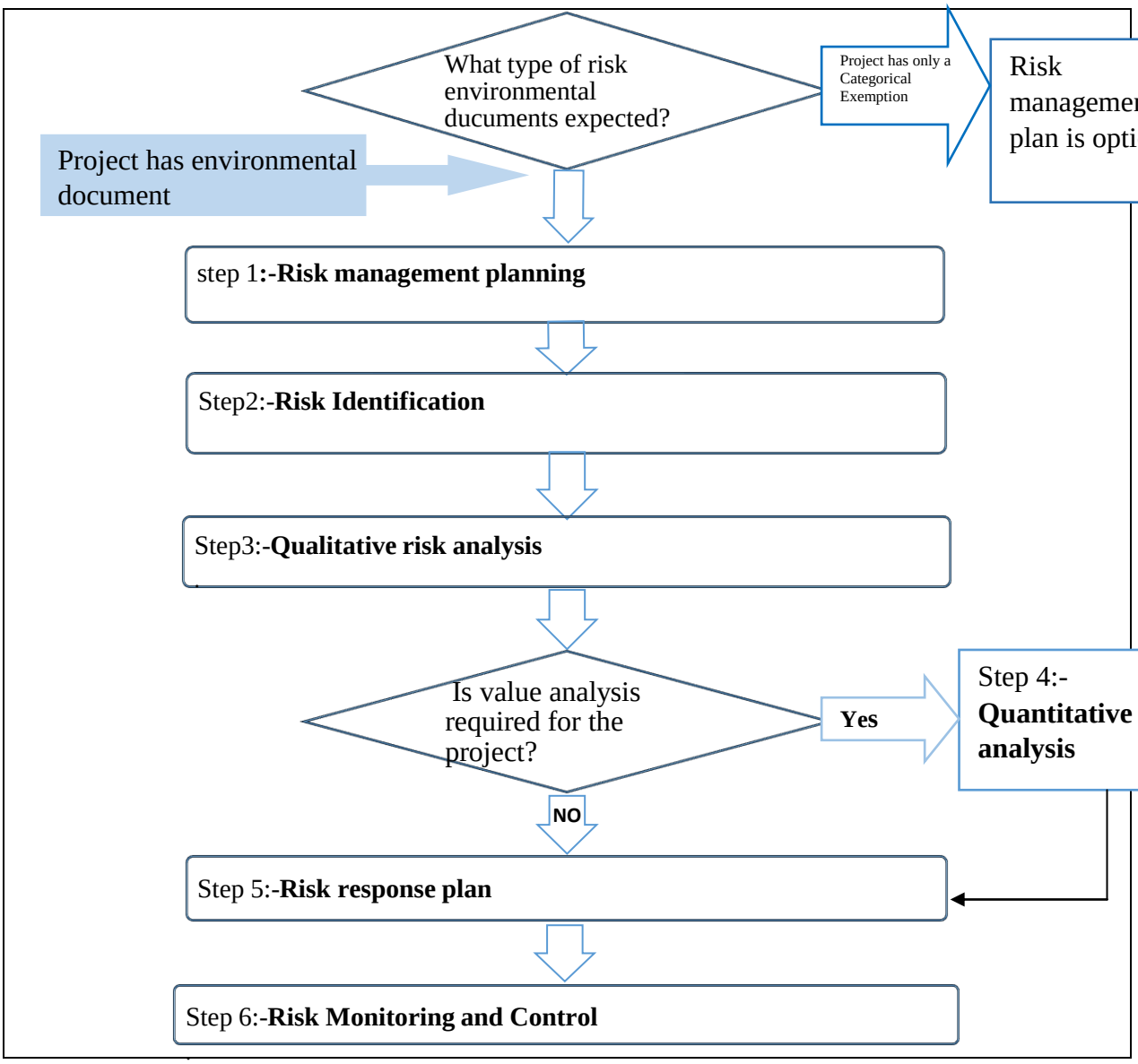

Fig. 2.2: Modified Risk Management Process flow chart (source: *Project Risk Management Handbook, 2000)*

2.7.1. Project risk management planning

The risk management plan identifies and establishes in the project plan the activities of risk management for the project. According to Jason (2006) the project activities, resources and financial expenditure have been planned in detail, it is time to identify and assess the level of project risk. As part of work plan development, project development team (PDT) members assign project team members to create a project risk management plan using spreadsheet that shows the risks and responses (PMI, 2000).The development of risk management planning depends up on the scope of project.

According to PMI (2000), a risk plan lists all of the foreseeable project risks and provides a set of actions required to prevent each risk from occurring and reduce its impact should it eventuate. A comprehensive risk plan includes a list of the foreseeable project risks;

- Rating of the likelihood of each risk occurring
- Description of the impact on the project should a risk actually occur
- Rating of the overall importance of each risk
- Set of preventative actions to be taken to reduce the likelihood of the risk occurring
- Set of contingent actions to be taken to reduce the impact should the risk eventuate
- Process for managing risk throughout the project

PMI (2000) puts that the risk management techniques at stage of planning. As in puts project charter, organization's risk management policies, defined roles and responsibilities, stake holders risk tolerance, work break downs and others by arranging planning meeting. The expected out puts are risk management planning which includes methodology, roles and responsibilities, budgeting, timing, scoring and interpreting, thresholds, reporting formats and tracking.

2.7.2. Project risk management identification

Risk identification involves identifying potential project risks and documenting their characteristics. According to Francis (2008) risk identification results in a deliverable the project risk list. The assigned team members identify the potential risks and opportunities, using:

- The sample risk list
- Their own knowledge of the project
- Consultation with others who have significant knowledge of the project or its environment

According to PMI (2000) participants in risk identification generally including the project team, risk management team, customers, end users, other project manager, stakeholders, outside experts and subject matter experts from other parts of the company.

According Francis (2008) and PMI (2004) risk management identification uses risk management plan, project planning out puts risk categories and historical information as in puts and using the following techniques and tools:

- Documentation reviews
- Information gathering techniques like
    - Brain storming
    - Delphi technique
    - Interviewing
    - Strengths, Weakness, Opportunities, and Threats (SWOT) analysis
- Check list
- Assumption Analysis
- Diagramming techniques

Finally the out puts of risk management identification are risks, triggers, symptoms or warnings and inputs to other processes.

Risk identification is iterative process, which have the following iteration stages as stated by (PMI, 2004)

- 1st Iteration may be performed by part of the project team, or by risk management team
- 2nd Iteration by the entire project team and primary stakeholders
- Final iteration to achieve unbiased analysis by persons not involved in the project.
- Simple and effective risk response can be developed and even implemented as soon as risk identification.

2.7.3. Project qualitative risk analysis

According to PMI (2004) Qualitative risk analysis assesses the importance of the identified risks and develops prioritized lists of these risks for further analysis or direct mitigation. According to Chapman and Ward (2004), the team assesses each identified risk for its probability of occurring and its impact on project objectives. Sometimes experts or functional units assess the risks in their respective fields and share these assessments with the team. Team members sort the identified risks into high, moderate, and low risk categories for each project objective (time, cost, scope). They rank risks by degrees of probability and impact, and include their assessment rationale. Team members revisit qualitative risk analysis during the project's lifecycle. When the team repeats qualitative analysis for individual risks, trends may emerge in the results. These trends can indicate

the need for more or less risk management action on particular risks, or whether a risk mitigation plan is working.

According to PMI (2004) the qualitative risk analysis in puts are risk management plan, identified risks, project status, project type, data Precision, scales of probability and impact and assumptions by using tools and techniques:

- Risk probability and Impact
- Probability/Impact risk rating Matrix
- Project Assumption testing
- Data precision ranking

Finally the out puts expected from qualitative analysis are:

- Overall risk ranking for the project
- List of Prioritized risks
- List of risks for additional analysis and management
- Trends in qualitative risk analysis results

2.7.4. Project quantitative risk analysis

According to PMI (2004) quantitative risk analysis is a way of numerically estimating the probability that a project will meet its cost and time objectives. Quantitative analysis is based on a simultaneous evaluation of the impact of all identified and quantified risks. The result is a probability distribution of the project's cost and completion date based on the risks in the project. Quantitative risk analysis involves statistical techniques that are most easily used with specialized software. The department should have specialists trained in these techniques and equipped with the necessary software. A specialist is assigned to assist each value analysis team. The team provides the specialist with the data needed to perform the analysis.

The department does not require quantitative analysis for projects; however, it strongly recommends that projects requiring value analysis, or those projects with an extremely high risk identified from the qualitative analysis, undergo quantitative risk analysis.

Deputy District Directors for Project and Program Management are responsible for identifying which of their projects will undergo VA during the following fiscal year, and for submitting a list of these projects to the District VA Coordinator.

Project managers must arrange for appropriate resources through the functional mangers, consultants, and design centers, and must include VA in the project schedules.

Quantitative risk management analysis inputs are depends up on project scope and data compiled, however risk management plan, identified risks, list of prioritized risks, list of risks for additional analysis and management, historical information, expert judgment, other planning out puts are the common.

The common tools and techniques used for quantitative risk analysis are the following (PMBOK, 2013):

- Interviews
- Sensitivity Analysis
- Decision tree analysis
- Simulation

According to PMI (2004) the out puts from quantitative risk analysis are:

- prioritized list of quantified risks
- probabilistic analysis of the project
- probability of achieving the cost and time objectives
- Trends in quantitative risk analysis

2.7.5. Project risk response analysis

Risk response planning focuses on the high-risk items evaluated in the qualitative and/or quantitative risk analysis. It identifies and assigns parties to take responsibility for each risk response. This process ensures that each risk requiring a response has an owner (PMI, 2004).

According to PMBOK (2013) the project manager and the PDT identify which strategy is best for each risk, and then design specific actions to implement that strategy using the inputs like risk management plan, list of prioritized, risk ranking of the project, prioritized

quantified risk, probabilistic analysis of the project, probability of achieving, list of potential Response, risk thresholds, risk owners, common risk cause and trends on qualitative and quantitative risk analysis results.

These strategies and actions taken at response analysis stage in PMI (2004) are as following including their detail definition:

- **Avoidance**. The team changes the project plan to eliminate the risk or to protect the project objectives from its impact. The team might achieve this by changing scope, adding time, or adding resources (thus relaxing the so called "triple constraint").
- **Transference**. The team transfers the financial impact of risk by contracting out some aspect of the work. Transference reduces the risk only if the contractor is more capable of taking steps to reduce the risk and does so.
- **Mitigation**. The team seeks to reduce the probability or consequences of a risk event to an acceptable threshold. They accomplish this via many different means that are specific to the project and the risk. Mitigation steps, although costly and time-consuming, may still be preferable to going forward with the unmitigated risk.
- **Acceptance**. The project manager and the project team decide to accept certain risks. They do not change the project plan to deal with a risk, or identify any response strategy other than agreeing to address the risk if and when it occurs. So, the out puts from risk response analysis includes:
  - Risk response plan
  - Residual risk
  - Secondary risk
  - Contractual agreements
  - Contingency reserve amounts needed
  - In puts to other process
  - In puts to revised project plan

2.7.6. Project risk monitoring and control

According to PRMHB (2003) risk monitoring and control keeps track of the identified risks, residual risks, and new risks. It also ensures the execution of risk response plans,

and evaluates their effectiveness. Risk monitoring and control continues for the life of the project. The list of project risks changes as the project matures, new risks develop, or anticipated risks disappear.

Periodic project risk reviews repeat the tasks of identification, analysis, and response planning (see previous tasks). The project manager regularly schedules project risk reviews, and ensures that project risk is an agenda item at all PDT meetings. Risk ratings and prioritization commonly change during the project lifecycle. The inputs used to project risk monitoring and control are risk management plan, risk response plan, project communication, additional risk identification and analysis and scope changes (PMI, 2004).

If an unanticipated risk emerges, or a risk's impact is greater than expected, the planned response may not be adequate. The project manager and the PDT must perform additional response planning to control the risk.

Risk control involves:

- Choosing alternative response strategies
- Implementing a contingency plan
- Taking corrective actions
- Re-planning the project

The functional manager assigned to each risk reports periodically to the project manager and the risk team leader on the effectiveness of the plan, any unanticipated effects, and any mid-course correction that the PDT must take to mitigate the risk. The common techniques and tools used for risk monitoring and control are (PMI, 2004):

- Project risk response risk response audit
- Periodic project risk reviews
- Earned value analysis
- Technical performance measurement
- Additional risk performance planning

Finally the out puts from risk monitoring and controls are:

- Work around plans
- Corrective action

- Project change requests
- Updates to the risk response plan
- Risk data base
- Updates to risk identification check list

2.8. Project Risk Management Practice

According to PMBOK (2013) and PMI (2004), a road construction work, just like any other social endeavor or undertaking, has vast and wonderful history of its own, since it evolved with the social development of mankind. Even if, contribution road construction is high in country development there is also environmental impact through construction process.

CDC (2006) the following best practice are recommended for project risk management

- **Identify early:-**identify potential risks as early in the project life cycle as possible. Document the initially identified risks in the project charter and clearly communicate their potential consequences to project sponsors and stakeholders.
- **Identify continuously:-**Continually identify and reevaluate project risk. When new risk is communicate update as needed.
- **Analyze:-**Analyze the potential impact of identified project risk. Repeat this analysis process throughout the project life cycle, make updates as needed.
- **Reprioritize:-**As risk risks are continually analyzed throughout project life cycle, reprioritize risks as potential project impact adjusts to changing project events.
- **Define and Plan: -** define risk thresholds, triggers, mitigation strategies, and contingency plans. The greater probability of the occurrence and/or impact on project goals, the more detailed this information should be
- **Communicate:-**Communicate regularly regarding risk status and changes in the level or overall project risks. Solicit feedback from project team members and stakeholders regarding known risk and prospect unknown risks. Store the risk management log in a location accessible to the project team, So that, if necessary, anyone can obtain updates at any time.
- **Update: -** Up date the risk management log on regular basis, both informally and formally.

- **Educate:-** Educate the entire project team and stakeholders on risk management and encourage them to actively identify, communicate, and mitigate risk

2.9. Project Risk Allocation

After risk assessment & following other risk management processes, allocation of risk comes in to picture. Such allocated risk, sharing of same, determines ownership of risk either by the employer or the contractor under the road construction contract. That is contractually important for its treatment under the relevant standard conditions of contract (Zewudu, 2012). It is important that the contract clauses allocating the risk are clear and unambiguous. The meaning the owner wishes to convey should be what the contractor interprets as cited by Getachew (2009) and Hartman and Snelgrove (1996) unforeseen ground conditions, unknown utilities, and inclement weather are examples of typical construction risks facing problems regarding inappropriate risk allocation in contract occurring in practice (Macdonald, 2001).

According to Zewudu (2012), when hazards are identified, assessed and analysed, their management must be allocated to one or more of the various parties in order to keep them under control, prevent the occurrence of any harmful consequences and thus reduce the extent of any risk of harm. Such allocation is part of the risk management process and should be carried out in accordance with appropriate rules rather than haphazardly. The rules for allocation of risks in a construction project may simply revolve around the ability of a party to:

- Control any arrangements which might be required to deal with the hazard or any triggering incident relating to it;
- Control the risk or to influence any of its resultant effects;
- Perform a task relating to the project, such as, obtaining and maintaining insurance cover; and
- Benefit from the project.

Risk allocation should be fair according to Addis (2014), allocating a risk that is predominantly within the control of one party to another party is unwise, because it is only accepted by a non-controlling party at a costly premium, thereby diminishing the value for money.

As cited by Addis (2014) and James & Bobotek (2011) said that ‘Some risks like force major are very difficult to allocate since no party has control over them. This kind of risks can be dealt with providing some provision in the contract, e.g. an agreement to negotiate if they arise.’

CHAPTER THREE

MATERIALS AND METHODS

3.1. Description of the Study Area

3.1.1. Location

The study of this paper was tried to address and understand the project risk management practice of Oromia Roads Construction Enterprise. The central location of head office is Addis Ababa, Nifas Silk Lafto, Woreda, 01. But, the projects selected for purpose of case study are randomly risk prone road construction projects constructed under the firm. Since the locations of these projects are far apart it is complicated to put using map detail. So, the point locations of the projects are Ejersa-Goro-Cinaksan found in east Hararge, Kercha-Skakisso found in Guji zone and Bege-Ketta in Jimma Zone. The parties involved are as Contractor (ORCE), Employer/client (ORA) and Engineer group (OWWDSE).

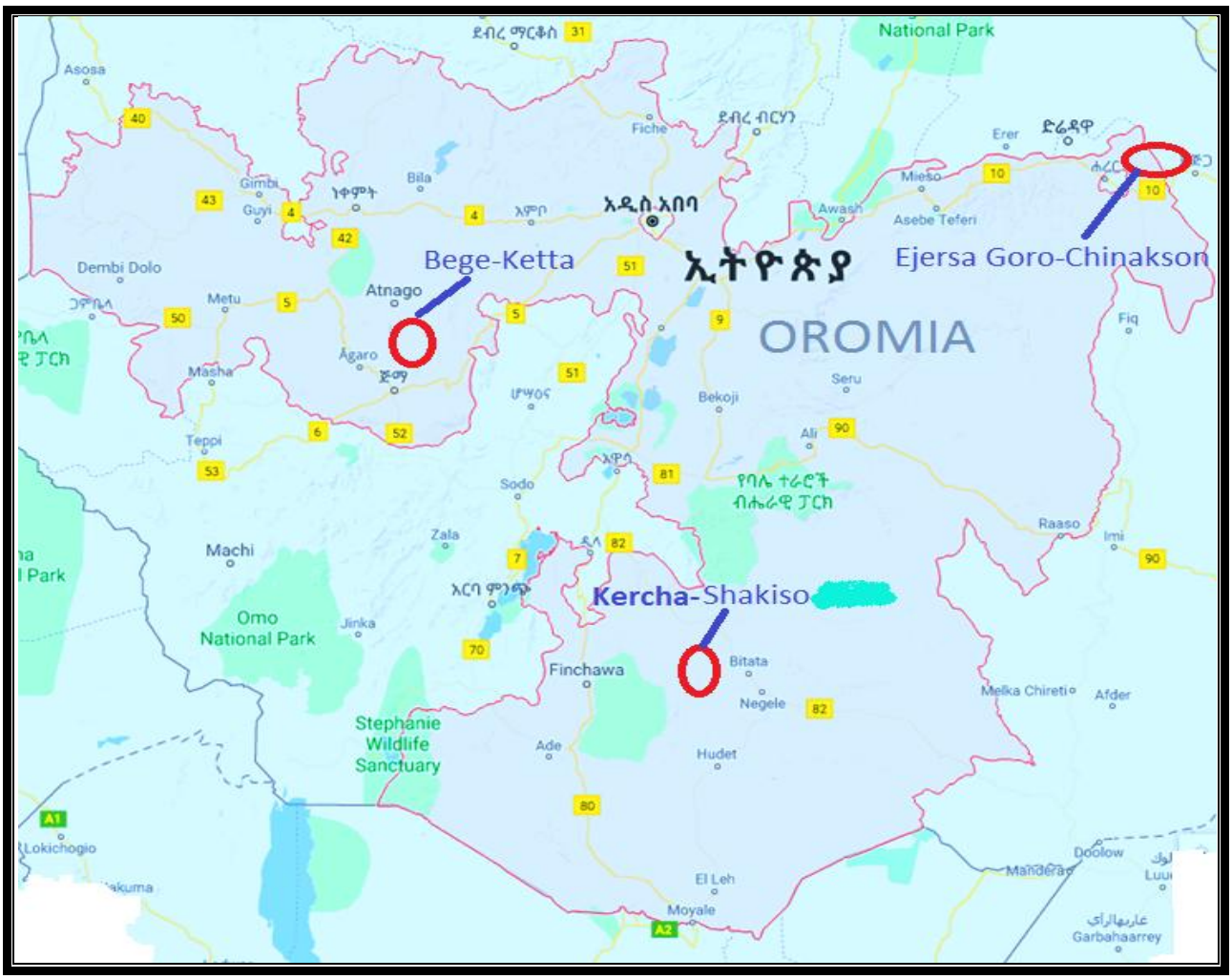

Fig: 3.1: The location of projects for case study (source: Google map web site)

3.2. Methodology

This chapter includes the methodology used in this study and provides about the research strategy, research design, case study of research location, questionnaire design, and questionnaire content and validity of questionnaire and data analysis. In addition, this chapter deals with the design of methodology to collect data's necessary to meet objective of this independent project about project risk management practice in Oromia Roads Construction Enterprise (ORCE).

3.2.1. Strategy

Data collected for the study was via both primary data collection and secondary data collection methods. The structured questionnaire is probably the most widely used data collection technique for conducting surveys to find out facts, opinions and views. So, the questionnaire was designed to answer the objective of the research. The other method used to collect data was case study on selected highly risk prone projects of ORCE through information gathered from contract and business administration core work process of firm and project managers of the selected projects. After the projects selected data relevant to such projects was collected and properly formatting was the major strategy. Tailored interviews were also used to seek information from those workers in sector as their respective positions and professions.

3.3. Data Sampling, Collection and Analysis

3.3.1. Sampling Data and Information

Major sources for data and information were Oromia Roads Construction Enterprise acts as contractor. Projects for case study were selected randomly by using information gathered from interviews of professional workers of the office.

3.3.2. Data Collection and Analysis

This study employed primary and secondary data. The primary data were collected through questionnaires and interviews of workers in mentioned sector. The interviews were supposed to have extensive experience on project cost overruns, delays and poor quality which is major areas of project risk. The information gathered through both interviews and questionnaires was supplemented and verified by explanations based on literature review.

A number of letters, condition of contract documents and working papers from Oromia Roads Construction Enterprise were also used as secondary data sources.

The study area was selected based on the preliminary study on the existing problems, that are, problems related to time and cost overruns and owners dissatisfaction with the quality of the completed construction projects, and knowledge of the area , which somehow helped me get easy access to available information.

The data was analyzed using both quantitative and qualitative approaches. Some statistics like the percentage of respondents has also been used to show the extent of the response.

The information gathered through these methods was supplemented by discussions based on literature review.

3.3.3. Interview methods

Interview is an effective way to obtain risk areas. Group interviews assist in identifying the base line of risk on project. Under this method the interview process is inherently a questionnaire process, so the brainstorming is accomplished after the risk list is given to the respondents. Finally, the comment from respondents was compiled and prepared for questionnaire purpose to investigate the impact on project objectives.

3.3.4. Questionnaires methods

Questionnaire was prepared for Oromia Roads Construction Enterprise workers to study project risk management practice. The questionnaire survey was classified under three parts and the first part is to investigate the awareness of workers about project risk management and the level of formal practice of project risk management in the sector. The second part of questionnaire was prepared for ranking of project risk management practice and assessment of cause and effects of construction risks. The third part of questionnaire was open questions and to assess the general practice of project risk management in the sector.

3.3.4.1. Response Rate

The data is collected from Oromia roads construction Enterprise 100% of workers at different construction department. About forty (40) questionnaires paper in number was distributed to the concerned peoples around construction projects like foreman, site

engineers, project managers, surveyors, office Engineers, professional workers at contract and construction work core processes and 7 (17.5%) of questionnaires are not returned and 33 (82.5%) questionnaires are filled and collected back correctly. The results are prepared to present the information about the sample size, response rate the actual practice of company in case of project risk management in roads construction.

3.3.4.2. Respondent's Personnel information

Personnel full information about respondents in detail is expressed as following. Since the study is specifically concerned on Oromia Roads Construction Enterprise the respondents designed under the department, professionals, experience of workers and educational status of the workers in the firm. So, all personnel information of the respondent was explained in detail under Table 3.1 below.

Table 3.1: Background of questionnaires respondents

SN	Areas or department of works	departments		Experience			Educational status		
		No of respondents	Percentage	Experience	No of respondents	Percentage	Academic back ground	No of respondents	Percentage
1	Contract Work core Process (at head office)	7	21.20	0-5	11	33.33	Diploma	2	6.06
2	Construction Work Process(at head office)	6	18.20	6-10	19	57.58	BSC	31	93.94
3	Construction Projects	20	60.60	11-15	3	9.09	MSC/ MENG	0	0
				>15	0	0	PHD	0	0
							Other	0	0
Total		33	100		33	100		33	100

3.3.5. Case study methods

The case study was prepared to answer the questions of "What are the sources of project risks in Oromia roads construction projects? And what are the contributions of project risks on cost overruns, project delays and poor quality of works? In order to obtain answer

for these questions 3 projects selected under this study. The data required was collected from Oromia Roads Construction Enterprise, Contract administration and business development core work process, Construction work core process and from project managers of the selected projects.

General information of case studies

Table 3.2: Sampled project descriptions

S. N	Road Construction Project Name	Project Location	Project length (km)	Client	Consultant & supervision	Length from Addis Ababa (km)	Current Status of project
1.	Ejersa-Goro-Cinaksan	East - Hararge	56.33	ORA	OWWDSE	640	Completed Nov. 16, 2016
2.	Shakisso-Boke-	Guji	44.9	ORA	OWWDSE	476	On progress
3.	Bege-Ketta	Jima	35.20	ORA	OWWDSE	180	On progress

Source: Compiled data from ORCE Profile, condition of contract and reports from contract and business administration core work process

CHAPTER FOUR

RESULT AND DISCUSSION

4.1. Introduction

This chapter reports and discusses the survey findings. After the questionnaire and interviews statistical analysis discussed under methodology is carried out and projects selected for case study including their full information also discussed under this chapter in detail. The result obtained from questionnaire also analysed in detail.

4.2. Results and Discussion on Awareness and Formal Practice of Project Risk Management

Project risk management discussed in detail under literature review as a systematic process used to maximize the probability and consequences of positive events and minimizing the probability and consequence of adverse events to project objectives, From the questionnaire survey of this research, it was discovered most of the respondents were aware of the concept of risk management as managing of risks that have a negative impacts on project objectives. Accordingly, among 33 respondents, 28 (84.8%) respondents have awareness of risk management practice while 5 (15.2 %) of respondents have no concepts about project risk management.

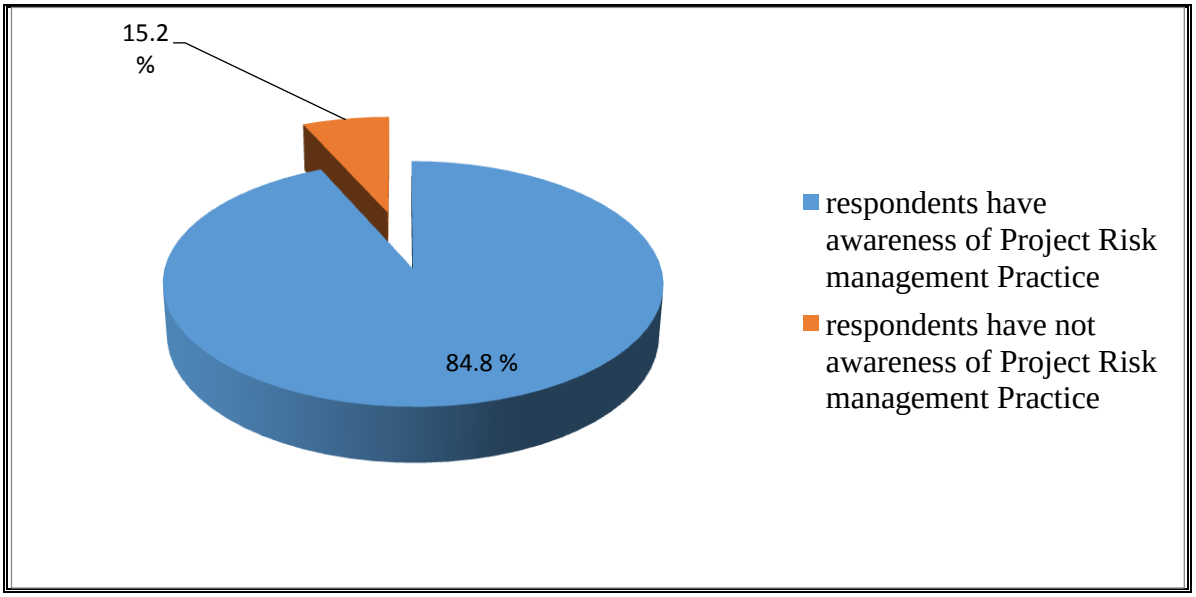

Fig 4.1: Awareness of project Risk management in Oromia Roads Construction Enterprise according to respondents

Under literature of review "Formal Project Risk Management includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project." Accordingly (Q1.2) was designed to asses about formal practice of project risk management in ORCE construction projects. So, 100% of construction projects under this sector respond as "*There is NO formal risk management practice takes place*." Under questionnaire survey of open question part III, Q. 1 and Q. 4, Project risk management is different from project to project, implies that starting from the planning and execution of a projects risk management under taken in a way that project manager thinks best. By contrast as literature review shows formal project risk management has rules that imply there are protocols for every steps and stage of planning oversight and control.

Another questionnaire survey to investigate the project risk management practice level and formal process of risk management techniques are documentation of risk areas and impacts in the progress of construction life-cycle. So, here there are practices of formal documentation processes as 33 respondents in ORCE. According to respondents about 90.9% said that there is no clear documentation and a proper, knowledge based and systematic data acquisition system is applied, only about 9.1% document what people thinking.

Table 4.1: Formal Risk Documentation practice applicable in Oromia roads construction Enterprise according to respondents

		Not applicable		**Applicable**	
	Risk Documentation practices	**Frequency**	**percentage**	**Frequency**	**percentage**
I.	At working site clearly documentation what people thinking.	30	90.9	3	9.1
II.	Clear communications between workers to write risks	21	63.6	12	36.4
III.	Familiarization new staffs to document risk causes	29	87.9	4	12.1
IV.	Using documents for risk claims	12	36.4	21	63.6
V.	A proper, knowledge based and systematic data acquisition system is applied	30	90.9	3	9.1

However, about 63.6% of respondents said that using documents for risk claims and 36.4% said that even if the data is documented they do not use for risk claims. In other

way the new staffs familiarized to document risk causes only about 12.1% and shows that no more communication between workers to write risks about 87.9% of respondents shows this.

According to Chris & Stephen (2003) documentation is a key feature of all formal processes. All project managers are aware of the importance of documentation for effective project management. Especially important because of the need to deal with uncertainty in terms of both variability and ambiguity

Therefore, depending up on result, in Oromia Roads Construction Enterprise, low practice of clear documentation of risk areas and causes; this indicates no formal practice project risk management techniques in the sector.

4.2.1. Result and Discussion on Project Risk allocation for Oromia Roads Construction Enterprise

Risk allocation should be fair according to Addis (2014), allocating a risk that is predominantly within the control of one party to another party is unwise, because it is only accepted by a non-controlling party at a costly premium, thereby diminishing the value for money. According to respondents of the company more or less half of the respondents about 51.52 % believe that there is no fair risk allocation when companies act as contractor, in addition depending on the open question Part III (Q.3) given to respondents some comments are as following.

- The inappropriate intervention of client and influence of local agencies makes difficult to manage project risks properly
- Sometimes the risks allocated under condition of contract to other parties are expected to overcome by contractor (ORCE). Example right of way, design problems, adjusting the area of construction materials etc.
- Allocating in sufficient budget makes also made contractor to plan project risks improperly. Figure 4.2 shows the respondents risk allocation in Oromia Roads Construction Enterprise

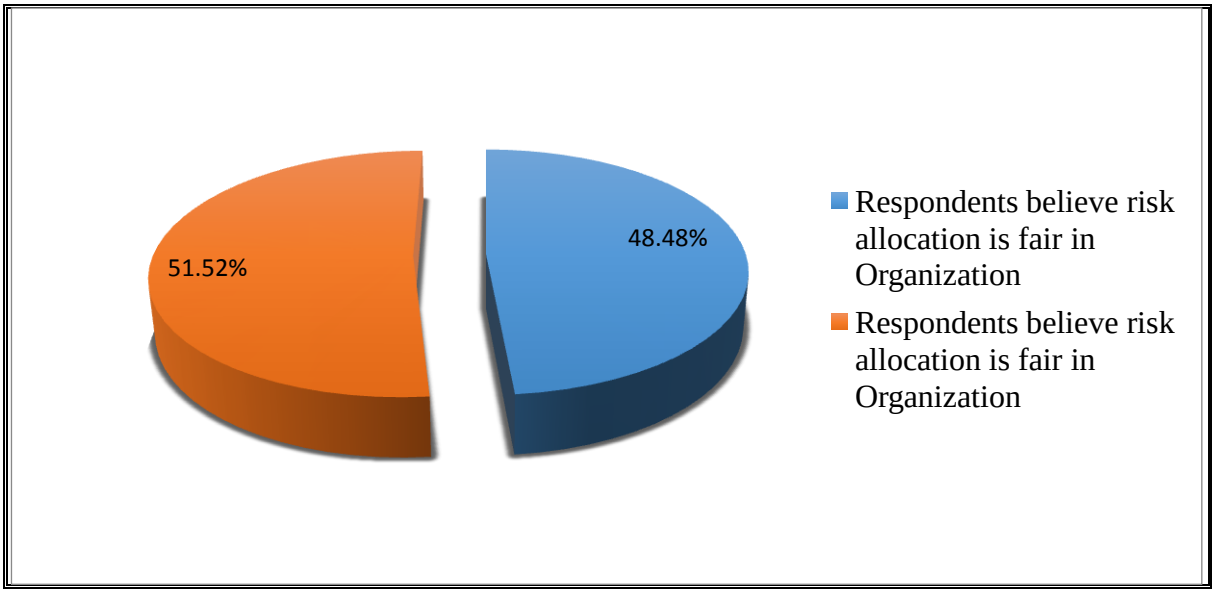

Fig 4.2: Project risk allocation in organization according to respondents

4.2.2. The level of use project risk management practice and assessment of cause and effects of construction risks

I. Aspects of monitoring and controlling the works practiced in Construction projects

From the data obtained as respondents, we can rank the aspects of monitoring and controlling the works practiced in construction projects of ORCE to minimize adverse impacts of project risks as following. In order to simply discuss let assign the letters aspects practiced below.

- **A**→Quality management, to assure that the work complies with the technical requirements
- **B**→ Actual schedule program compared against project schedule during construction phase always.
- **C**→The cost status checked to establish how actual performance compares with budget thoroughly.

The options of ranking by respondents may A→B→C, A→C→B, B→A→C, B→C→A, C→A→B and C→B→A. Accordingly, the ranking of aspects of monitoring and controlling the works in construction projects to minimize adverse impacts of risks

Table 4.2: Major aspects of monitoring and controlling the works in construction projects ranked as respondents

Aspects ranked as respondents		Frequency	percentage
I.	Respondents rank as C-B-A	13	39.4
II.	Respondents rank as B-C-A	9	27.3
III.	Respondents rank as B-A-C	5	15.2
IV.	Respondents rank as A-C-B	3	9.1
V.	Respondents rank as C-A-B	2	6.1
VI.	Respondents rank as A-B-C	1	3
	Total	33	100

As indicated in Table 4.3 the respondents ranked the aspects of monitoring and controlling the works in construction projects about 39.4 % is the cost status checked to establish how actual performance compares with budget thoroughly is first, actual schedule program compared against project schedule during construction phase always, as second and thirdly quality management, to assure that the work complies with the technical requirements. The other detail of ranking according to respondents clearly explained above in Table 4.3.

II. The importance of risk management during the construction phases

Table 4.3: Ranking of risk management importance in construction phases according to respondents

Responses	Project Construction Phases							
	Conceptualization and Contract signing		Planning and Scheduling		Execution or Construction		Termination	
	frequency	Percentage	frequency	Percentage	frequency	Percentage	frequency	Percentage
Very low	2	6.1	1	3	2	6.1	7	21.2
Low	1	3	3	9	0	0	14	42.4
Moderate	6	18.2	2	6.1	16	48.5	9	27.3
High	15	45.5	12	36.4	14	42.4	3	9.1
Very High	9	27.3	15	45.5	1	3	0	0
Mean	**3.85**		**4.12**		**3.36**		**2.24**	
Total	**33**	**100**	**33**	**100**	**33**	**100**	**33**	**100**

Risk management plays an important role in maintaining project stability and efficiency throughout the project life cycle, even if the project risk management is very essential in all phases of construction, in this study questionnaire prepared and distributed to ORCE to identified at what level project risk management is important under phases of construction. Accordingly depending on its importance the level is justified as very low=1, low=2, moderate=3, high=4 and very high=5. The numbers of respondents and their percentage were placed under each category for each stage of construction. The mean values were calculated to get the average values of the importance of risk management at each stage of construction.

The survey result under each construction phases depending up on the above levels shows that mean value of 4.12 of respondents were believe that the importance of project risk management at planning and scheduling phase is very high, 3.85 at conceptualization and design phases is under high level, 3.36 respondents as execution or construction phases and the importance of termination is low level with respondents of mean value 2.24. In other words depending up on the respondent percentage the relative level of project risk management importance at construction phases more explanation is observed by Figure 4.3 of bar graph. Risk management in construction project is very high during planning and scheduling in construction projects and followed by during conceptualization and contracting phase according to respondents. The construction stages of conceptualization and design phase, execution and planning and scheduling are respectively the level at high project risk management is important.

Generally respondents believe that termination of construction project is the phase at project risk management is not more important as shown in Figure 4.3

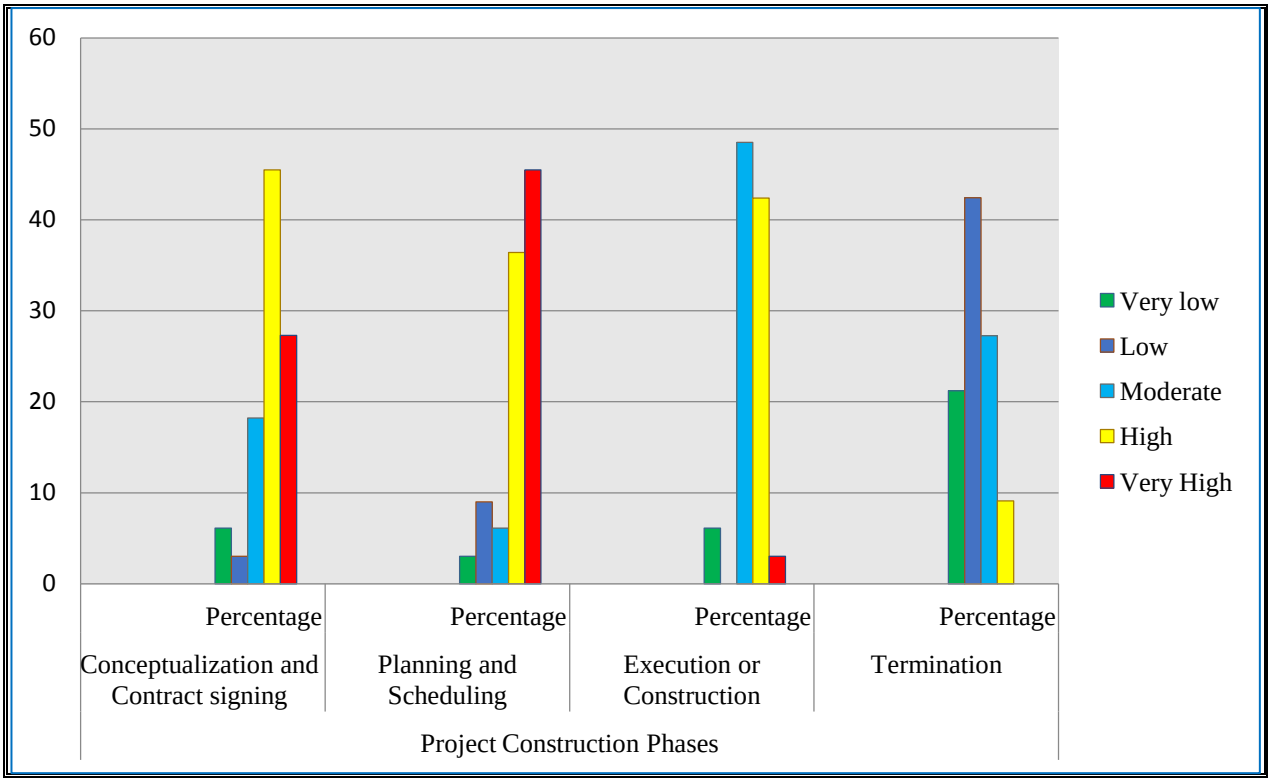

Figure 4.3: Importance of risk management in project construction phase

4.2.3. The effect of different areas and causes of risk on project objectives

This section contained responses questions that relates to the management of project risk in ORCE and the effect it has on the project objectives. As in literature review try to discussed, once the project risk is identified as the risks affect the project objectives it is easy to manage by following risk management procedures to minimize the adverse effect of it. Depending on the questionnaires and respondents data this section can be discussed in two categories.

Ranking of major common risk areas that affects the objectives of project in Oromia Roads Construction Enterprise.

Table 4.4: Ranking of major common risk areas in ORCE according to respondents

Common Risk Areas related to	Risk Impacts												Total respondents
	Cost related				Time related				Quality related				
	Frequency			mean value	Frequency			mean value	Frequency			mean value	
	Low	moderate	High		Low	moderate	High		Low	moderate	High		
A. Natural	13	17	3	1.70	6	15	12	2.18	5	14	14	2.27	33
B. Physical	0	25	8	2.24	3	27	3	2.00	8	20	5	1.91	33
C. Financial	0	7	26	2.79	2	16	15	2.39	10	14	9	1.97	33
D. Political and Environmental	7	17	8	2.09	4	21	8	2.12	5	24	4	1.97	33
E. Design	2	9	22	2.61	1	8	24	2.70	1	5	27	1.79	33
F. Construction	1	10	22	2.64	0	9	24	2.73	0	4	29	2.88	33
G. Contractual	1	10	22	2.64	1	9	23	2.67	2	12	19	2.52	33
H. Project management	7	10	16	2.27	0	8	25	2.76	0	6	27	2.82	33
I. Others	3	2	4	0.58	3	4	3	0.63	0	2	1	0.21	9

The most common risk areas to be ranked by respondents are under impacts of cost, time and quality, so the discussion of impacts are independently prepared as following.

4.2.3.1. Cost related impacts of risk areas ranking

The questionnaire survey was made to investigate the impact of major risk areas on project objectives as a general and now under this sub- topic the impact on cost is observed in detail. So, as shown in the Fig. 4.4, the representation is as 1= low, 2= medium, 3=high and finally according to respondents the mean value is calculated for compression, as a result the financial related risk areas with a mean value of 2.79 followed by construction related risk areas and contractual related risk areas with the same value of mean 2.64 were found to have the highest impact on cost while natural related of 1.70 and political related risk areas with mean value of 2.09 have the lowest impact on cost.

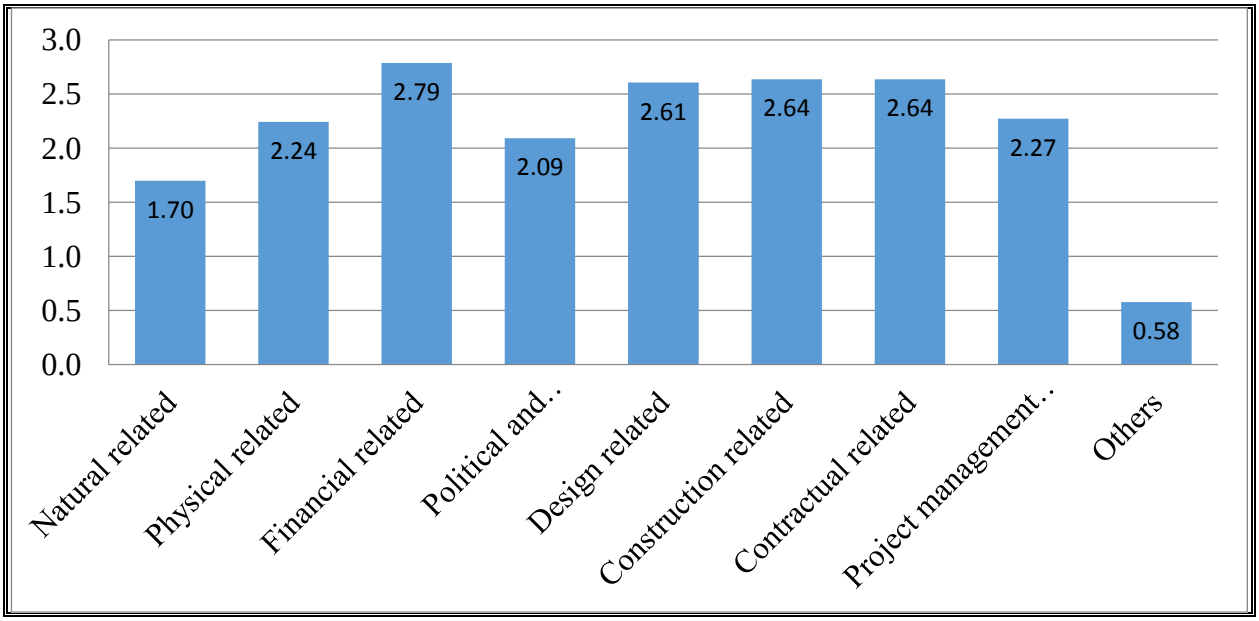

Fig 4.4: Cost related ranking of major risk areas in ORCE according to respondents

4.2.3.2. Time related impacts of risk areas ranking

The questionnaire survey was made to investigate the impact of major risk areas on project objectives as a general and now under this sub- topic the impact on time is observed in detail. So, as shown in the Fig. 4.5 the representation is 1= low, 2= medium, 3=high and finally according to respondents the mean value is calculated for compression, as a result the project management related risk areas with a mean value of 2.76 followed by construction related risk area of 2.73 were found to have the highest impact on cost while physical related risk areas with 2.00 mean value and political and environmental related risk areas with mean value of 2.12 have the lowest impact on cost.

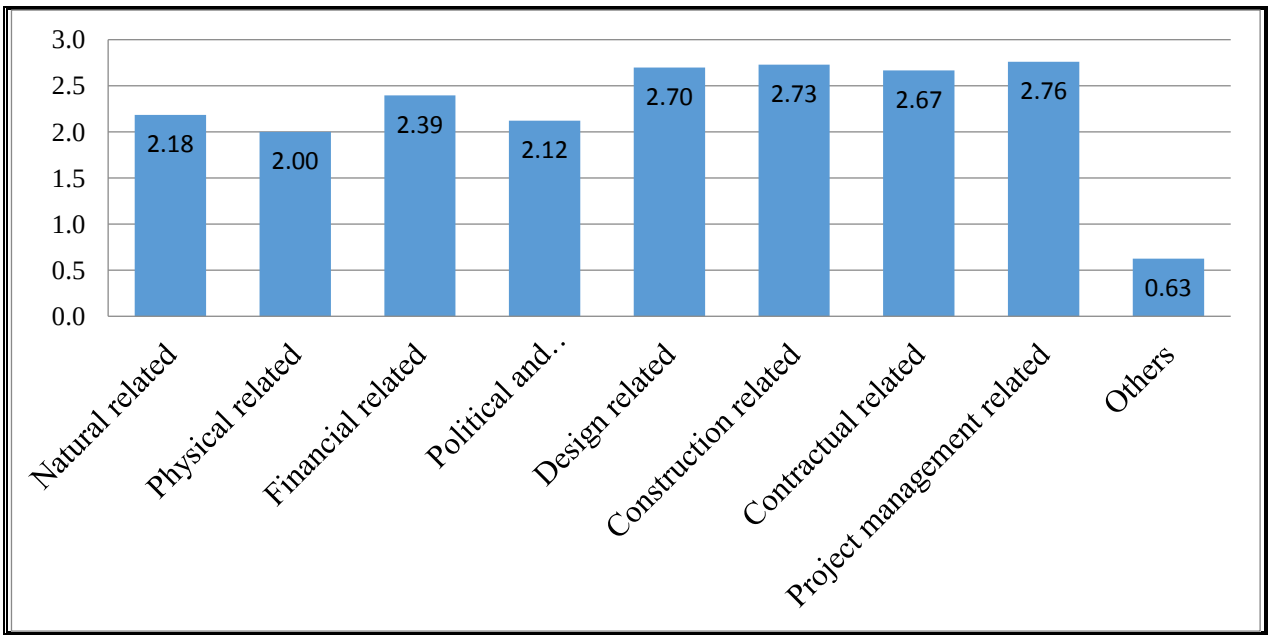

Fig. 4.5: Time related ranking of major risk areas in ORCE according to respondents

4.2.3.3. Quality related impact risk areas ranking

The questionnaire survey was made to investigate the impact of major risk areas on project objectives as a general and now under this sub- topic the impact on quality is observed in detail. So, as shown in the Fig.4.6 the representation is 1= low, 2= medium, 3=high and finally according to respondents the mean value is calculated for compression, as a result the construction related risk areas with a mean value of 2.88 followed by project management related risk area of 2.82 were found to have the highest impact on quality while design related with 1.79 mean value and physical related risk area with a mean value of 1.92 have the lowest impact on quality.

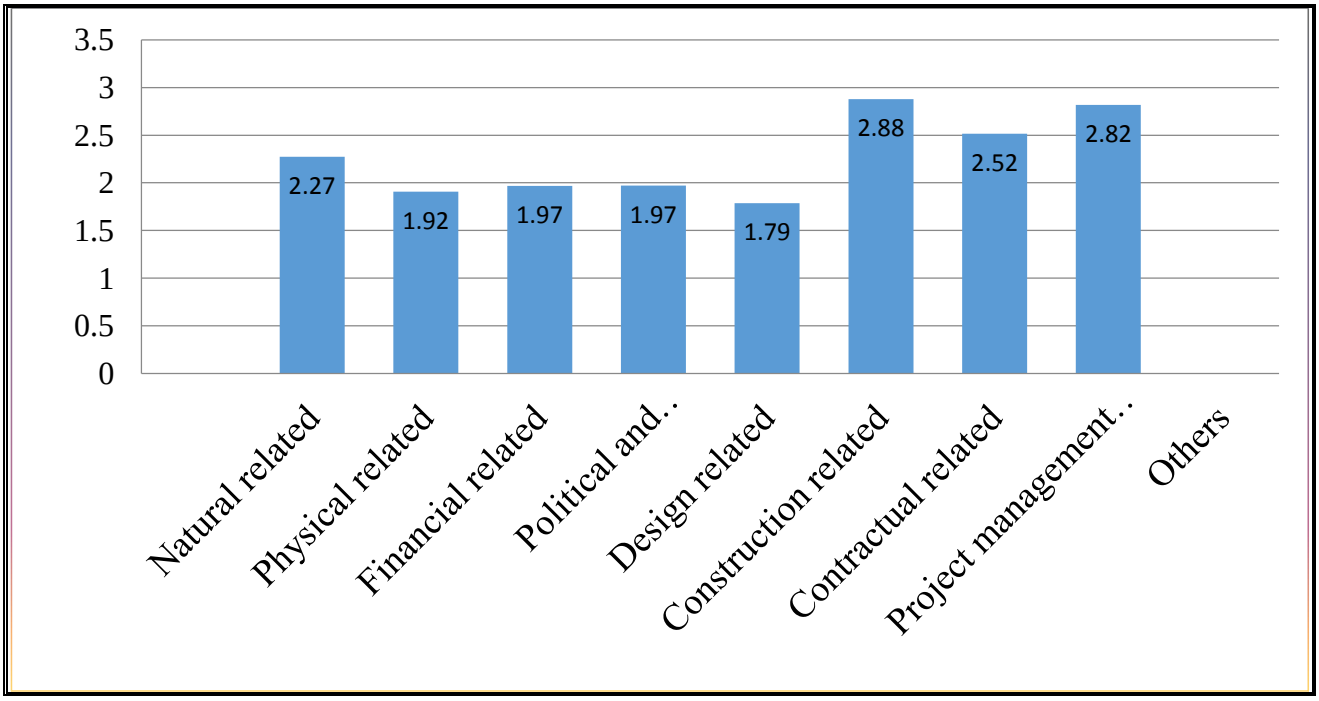

Fig. 4.6: Quality related ranking of major risk areas in ORCE according to respondents

Calculating the average value of mean for cost, time and quality; over all the respondents believe construction related risk area with value of 2.75, project management related risk areas with 2.62, Contractual related risk areas with 2.61and financial related risk areas 2.38 have the highest impact on Project objectives in Oromia Roads Construction Enterprise respectively.

The major causes of risks, Probability of their occurrence and their level of impact on project objectives according to respondents was clearly observed below.

In construction projects there are many causes of risks from inception to termination of construction projects. Similarly, in ORCE the causes of risks are enormous and the major part of risks are selected during interview of construction expertise and compiled under eight different sub-topics and prepared as questionnaire survey to investigate their probability of occurrence and level of impact through meting the project objectives.

Risk management was defined as a process by which the likelihood of the risk occurring or its impact/consequence on project is reduced. If the risk is very unlikely to occur and if its consequence is minor, then it's of less importance to the construction sector. On other hands if the risk is likely to occur and causes major consequences, then the risk is of major concern to everyone involved in the project.

In this section the respondents were asked to rate the probability of occurrence of the different areas of risks and level of consequences they lead to if they occur. Accordingly, probability of occurrence and the level impacts on cost, time and quality is represented as low=1, moderate=2 and high=3 to calculate the mean score which is used to investigate the probability of occurrence and level of impact on project objectives.

As can be observed from the Table 4.6, the major causes of risk that are believed to have the highest probability of occurrence right of way under construction category, in adequate site information under contractual related risk areas and poor documentation system under project management related risk areas with a similar mean score of 2.7, Design error and omission under design related, Inaccurate contract time estimation, Slow site hand over, In accurate cost estimation were risk areas with a mean value of 2.6 (1=low and 3=high). The major cause of risk that is identified by most respondents to have the highest influence on time is ceasing of works due to rain at construction site with a mean score of 2.7. In accurate cost estimation and slow site hand over under category of contractual related risk have the highest influence on cost with a mean value of 2.7, and defective design was identified to have the highest influence on quality with a mean score of 2.7.

According to the reviewed literature, risks which have low likelihood of occurrence and low impact if they manifest are said to be minor risks and they require no further action. The biggest concern of risk management is handling the major risks i.e. risks with high probability of occurrence and which have great impact if they take place.

Table 4.5: Construction related cause of risk areas , probability of occurrence and their impact

SN	Construction Related Causes of Risk Areas	Total no of respondents	Likelihood of Occurrence (depending on frequency of respondents)				Impacts											
							Cost related				Time related				Quality related			
			High	Moderate	Low	Mean	High	Moderate	Low	Mean	High	Moderate	Low	Mean	High	Moderate	Low	Mean
	A. Natural related risks																	
1	Un expected flood	33	0	20	13	1.6	16	12	5	2.3	3	22	8	1.8	22	5	6	2.5
2	Un expected land slides	33	2	16	15	1.6	11	18	4	2.2	4	20	9	1.8	22	5	6	2.5
3	Ceasing of works due to rain	33	19	11	3	2.5	10	20	3	2.2	25	6	2	2.7	11	14	8	2.1
	B. Physical Related risks																	
1	Frequent of damage Equipment	33	13	17	3	2.3	15	15	3	2.4	16	14	3	2.4	6	8	19	1.6
2	Labour injuries at construction site	33	2	9	22	1.4	1	6	26	1.2	3	16	14	1.7	1	5	27	1.2
3	Theft of construction materials	33	0	10	23	1.3	0	13	20	1.4	0	12	21	1.4	3	10	20	1.5
4	Shortage of plant and equipment	33	4	25	4	2.0	7	21	5	2.1	11	12	10	2.0	7	19	7	2.0
5	Un skilled labour for equipment maintenance	33	2	19	12	1.7	16	9	8	2.2	5	13	15	1.7	6	8	19	1.6
	C. Financial and Economic																	
1	Financial inflation	33	9	17	7	2.1	19	8	6	2.4	17	12	4	2.4	10	13	10	1.8
2	Funding changes for fiscal year from client	33	19	7	8	2.3	19	7	7	2.4	19	7	7	2.4	7	16	10	2.0
3	Shortage of internal financial cash flow	33	8	23	2	2.2	11	19	3	2.2	10	23	0	2.3	5	10	18	1.9
	D. Political and Environmental risks																	
1	Changes of rules and regulation	33	1	10	22	1.4	2	16	15	1.6	7	14	12	1.8	5	10	18	1.6
2	Requirements for permits of construction material and site camp, etc	33	12	15	6	2.2	6	18	9	1.9	16	15	2	2.4	9	19	5	2.1
3	The influence of law and order	33	1	12	20	1.4	0	21	12	1.6	4	15	14	1.7	4	12	17	1.6

4	Pollution and environmental safety	33	0	10	23	1.3	0	12	21	1.4	4	6	23	1.4	4	7	22	1.5
5	Priorities change on existing program	33	5	20	8	1.9	3	22	8	1.8	10	17	6	2.1	4	18	11	1.8
6	New stakeholders emerge and demand new work	33	0	5	28	1.2	2	8	23	1.4	6	9	18	1.6	2	10	21	1.4
7	Change in scope of work	33	14	16	3	2.3	16	15	2	2.4	19	13	1	2.5	18	9	6	2.4
	E. Design related risks																	
1	Incomplete working design	33	20	11	2	2.5	16	12	5	2.3	9	22	2	2.2	21	9	3	2.5
2	Defective design	33	15	18	0	2.5	16	13	4	2.4	10	23	0	2.3	23	10	0	2.7
3	Design error and omissions	33	19	14	0	2.6	18	11	4	2.4	7	26	0	2.2	22	10	1	2.6
4	Design changes	33	15	16	2	2.4	17	16	0	2.5	16	17	0	2.5	15	13	5	2.3
	F. Construction Related																	
1	Labour disputes	33	0	25	8	1.8	5	16	12	1.8	7	19	7	2.0	4	16	13	1.7
2	Low labour productivity	33	3	24	6	1.9	20	10	3	2.5	11	18	4	2.2	9	15	12	2.0
3	Un expected different site condition	33	2	26	5	1.9	10	19	4	2.2	11	16	6	2.2	6	15	12	1.8
4	workers Lack of experience	33	1	26	6	1.8	9	16	8	2.0	13	14	6	2.2	19	9	5	2.4
5	Poor productivity of plant and equipment	33	1	31	1	2.0	21	12	0	2.6	16	14	3	2.4	10	11	12	1.9
6	Improper construction methods	33	0	29	4	1.9	19	12	2	2.5	13	16	4	2.3	21	11	1	2.6
7	Errors during construction	33	2	20	11	1.7	19	8	6	2.4	14	8	11	2.1	21	7	5	2.5
8	Inappropriate intervention by client	33	15	11	7	2.2	17	8	8	2.3	18	11	4	2.4	17	12	4	2.4
9	Client choose time and cost over quality	33	17	11	5	2.4	7	11	15	1.8	3	14	16	1.6	20	9	4	2.5
10	Right of way problems	33	12	17	4	2.7	19	11	3	2.5	14	17	2	2.4	7	18	8	2.0
11	Influential stake holders need their satisfaction	33	2	9	22	1.4	1	22	10	1.7	1	16	16	1.5	4	11	18	1.6
12	Insufficient time to plan risks	33	2	7	24	1.3	4	10	19	1.5	5	9	19	1.6	8	5	20	1.6
	G. Contractual related risks																	
1	In adequate site information	33	22	11	0	2.7	22	10	1	2.6	17	16	0	2.5	20	13	0	2.6
2	Inaccurate contract time estimation	33	24	4	5	2.6	21	8	4	2.5	25	4	4	2.6	21	8	4	2.5
3	Inaccurate work break downs	33	20	6	7	2.4	24	6	3	2.6	16	13	4	2.4	10	15	8	2.1

4	Slow site hand over	33	23	8	2	2.6	24	8	1	2.7	21	9	3	2.5	19	9	5	2.4
5	In accurate cost estimation	33	22	8	3	2.6	24	7	2	2.7	10	16	7	2.1	9	12	12	1.9
6	Missing of items in condition of contract documents	33	10	19	4	2.2	16	13	4	2.4	4	21	8	1.9	10	14	9	2.0
7	Limitation of specification in condition of contract	33	2	19	12	1.7	2	18	13	1.7	1	19	13	1.6	6	17	10	1.9
8	Ambiguity of risk in condition of contract	33	2	25	6	1.9	1	19	13	1.6	2	25	6	1.9	6	23	4	2.1
	H. Project Management related risks																	
1	Project purpose and need is poorly defined	33	0	24	9	1.7	2	20	11	1.7	7	15	11	1.9	4	19	10	1.8
2	Project scope definition is poor or incomplete for management	33	0	21	12	1.6	3	17	13	1.7	9	12	12	1.9	4	15	14	1.7
3	The number of projects affect to control	33	0	13	20	1.4	0	13	20	1.4	0	11	22	1.3	2	11	20	1.5
4	Improper quality control and testing methods	33	4	20	9	1.8	7	19	7	2.0	3	16	14	1.7	17	12	4	2.4
5	Estimating or scheduling errors	33	4	19	10	1.8	7	19	7	2.0	13	15	5	2.2	6	20	7	2.0
6	Miscommunication between project team	33	0	21	12	1.6	12	15	6	2.2	10	14	9	2.0	13	15	5	2.2
7	Pressure to deliver project on an accelerated schedule	33	19	10	4	2.5	6	19	8	1.9	5	12	16	1.7	22	8	3	2.6
8	Lack of upper management support	33	4	17	12	1.8	2	20	11	1.7	5	17	11	1.8	4	17	12	1.8
9	Lack of resource availability	33	9	22	2	2.2	9	18	6	2.1	13	17	3	2.3	9	20	4	2.2
10	Influence local agency issues	33	4	18	11	1.8	1	19	13	1.6	8	13	12	1.9	8	12	13	1.8
11	Negative Public awareness or support about project	33	4	15	4	1.7	5	16	12	1.8	6	8	19	1.6	6	9	18	1.6
12	Poor Documentation system of risks	33	24	8	1	2.7	19	11	3	2.5	19	7	7	2.4	20	6	7	2.4
13	Internal bureaucracy problems	33	18	9	6	2.4	15	11	7	2.2	20	7	6	2.4	14	10	9	2.2

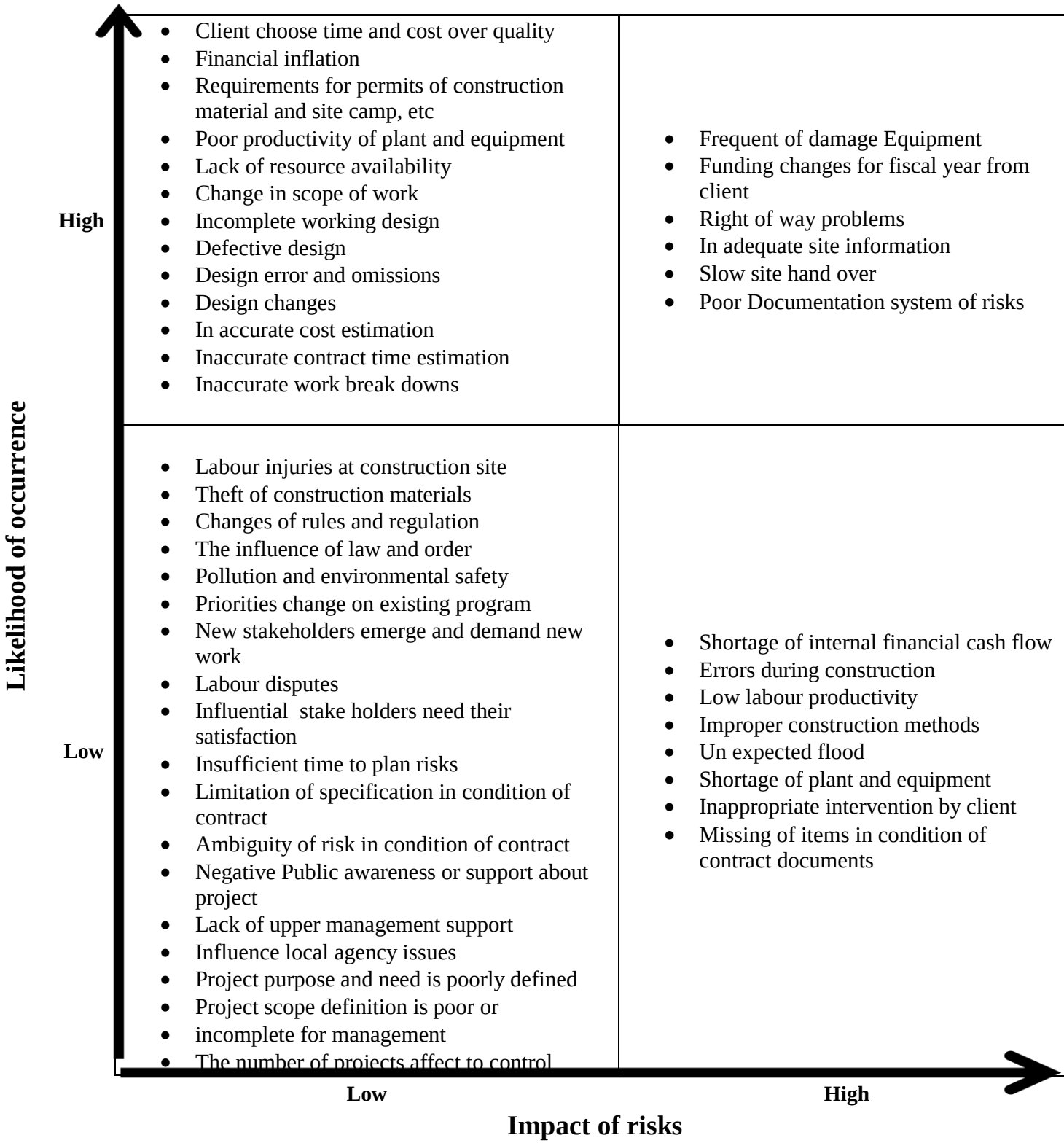

Fig. 4.7: Causes of risk areas having an impact on cost

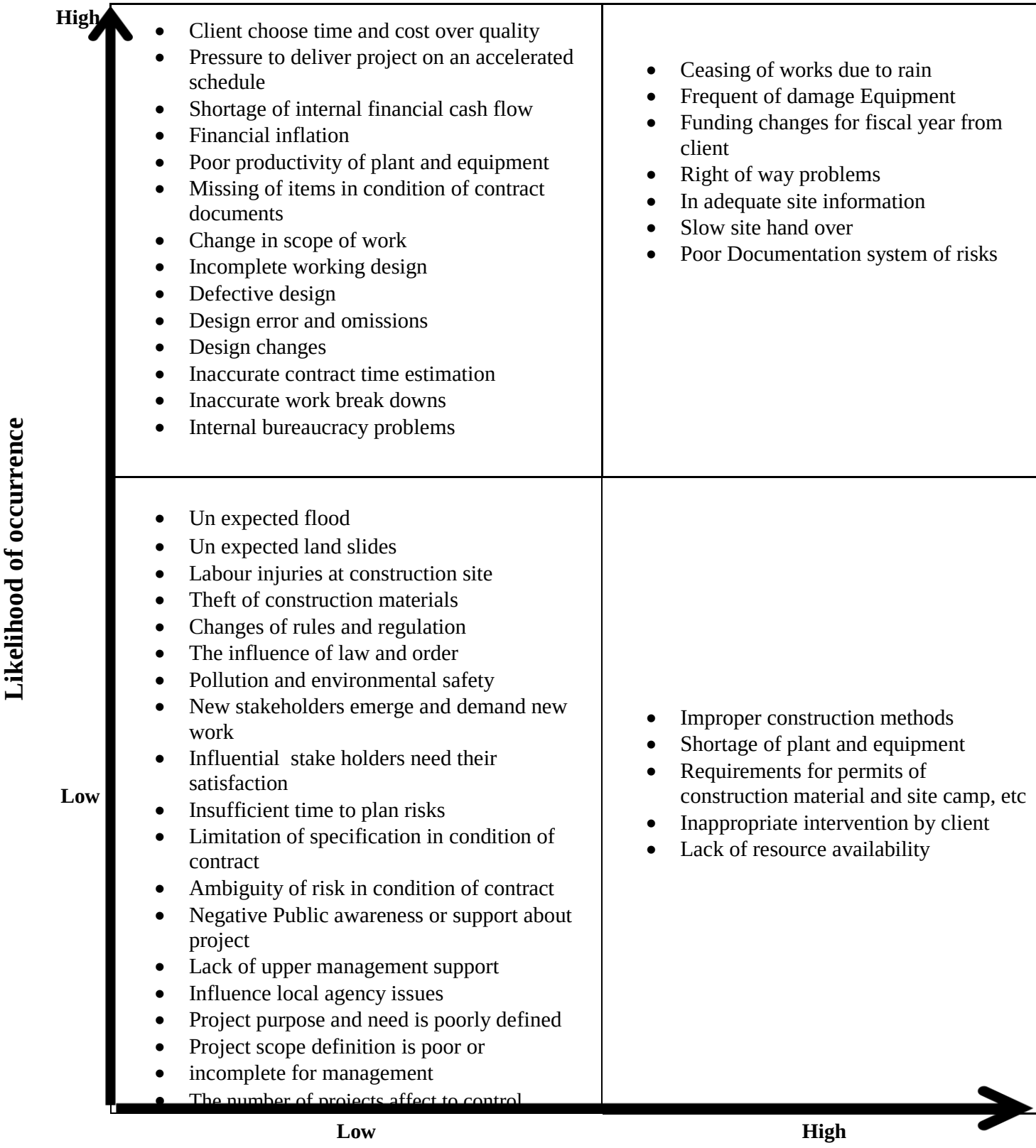

Fig. 4.8: Causes of risk areas having an impact on time

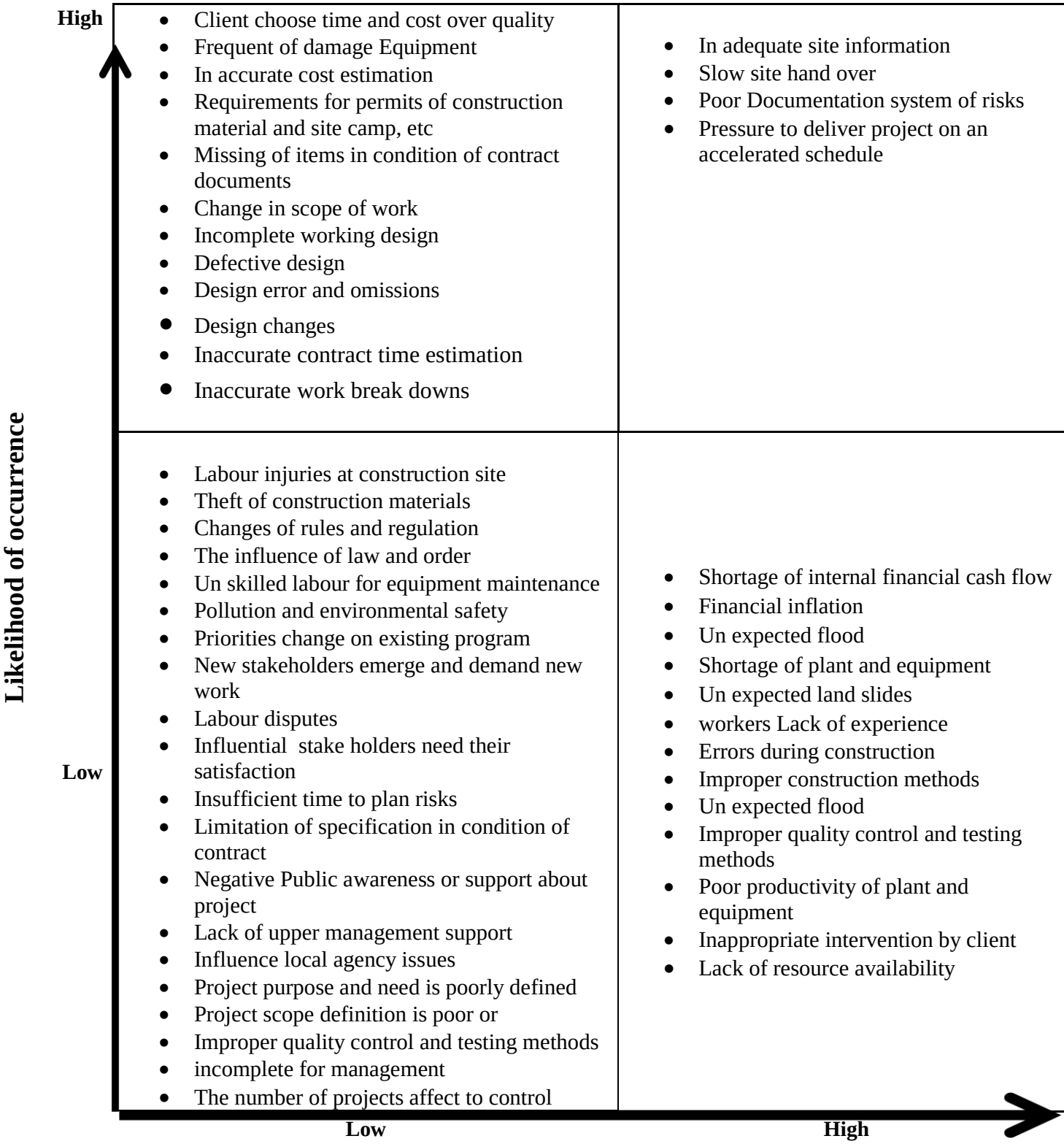

Fig. 4.9: Causes of risk areas having an impact on quality

According to matrices formed for respondent frequency after the calculation of mean scores the following project risks are discovered as the causes of risk areas with

Probability of occurrence high versus impacts on project is high, depending on the respondent frequency value of mean squares on impact of time, cost and quality is averaged. The 5 most external and uncontrolled project risk areas are assessed as following;

1. In adequate site information
2. Slow site hand over
3. Poor Documentation system of risks
4. Right of way problems
5. Ceasing of works due to rain

As discussed under literature review, a risk ranking matrix can be used for categorizing the risk as minor, moderate or major and decide on the action to be taken. Minor risks can be accepted, moderate risks need some management measures and for major risks with high probability of occurrence and high impact a serious risk action schedule needs to be devised to manage the risks listed above in ORCE. So, the discovered cause of risk areas have high impact on project objectives through cost overruns, time extensions and poor quality of works.

4.2.4. Project risk mitigation methods in Oromia Roads Construction Enterprise

The questionnaire survey of part three question numbers Q.1, Q.2, Q.4 and Q.5 was distributed to 33 respondents to assess the way of risk mitigation management systems of the sector. Accordingly the responds for question about what methods they use to manage the project risks, most of them replied that they use individual judgment and past experience methods. This shows that "no formal technique of project risk management is applied in sector".

According to respondents three parties; contractor, consultant and clients are responsible for project risk management. In addition the peoples around the project should be involved in the project risk management according to 9 respondents.

The recommendation given by respondents about project risk management in order to overcome project cost overruns, delays and poor quality and meet project objective were as following;

- Expert for risk management should be assigned
- Project risk documentation system should be proper
- Formal risk management practice should be cultured
- Training to aware every workers should be prepared by office
- Risk allocation under condition of contact should be clearly stated
- Good communication about project risks between workers should be developed

According to respondents no formal techniques of project response methods are applied. However, some of risks accepted as a common problem simply and risk transfer trough insurance is applied as responded by 2 respondents.

4.3. Case Study of Selected Road Projects in Oromia Roads Construction Enterprise

This study covers three (3) risk prone roads construction project constructed by Oromia roads construction Enterprise (ORCE), all of these projects supervised by Oromia Water Works Designed and Supervision Enterprise (OWWDSE) and client of these projects is Oromia Roads Authority (ORA).

Case Study 1
Ejersa Goro-Cinaksan project

Cost related data

Table 4.6: Project cost related data for Ejersa-Goro-Cinaksan

SN	Description	Amount (ETB)	Date agreement
1.	Main contract amount	92,948,939.56	11/10/2010
2.	Amendment no 1	135,994,693.63	23/04/2014
3.	Variation order no 1	154,762,795.72	13/07/2016

Source: compiled from condition of contract agreements and formal letters

- Total value of executed and material supplied birr 279,865,319.22 ETB
- According to contract agreement the advance payment asked was 12,396,201.90 ETB, but the amount allocated was 4,343,000.00 ETB from finance and procurement work process at 10/11/2010.

Time related data

- Commencement date.....Nov. 17, 2010
- Original completion date .....April 29, 2012
- Contract completion time.....560 calendar days
- Total completion date of the project .....2165 calendar days

Case Study Analysis 1
Ejersa Goro-Cinaksan project analysis

Cost overruns

- Total project cost overrun=279,865,319.22-92,948,939.56

=**186,916,379.60 ETB**

Cost overrun case 1

Amendment no 1 made between Oromia Roads Authority (ORA) and Oromia Roads Construction Enterprise (ORCE) through the presence of engineer from Oromia Water Works Design and Supervise Enterprise (OWWDSE) as date indicated at table 4.8. The amendment made was;

- Due to discrepancy between the design of the road and the bill of quantity in the contract agreement
- The volume of work in the design is large as compared to that in bill of quantity which means that the quantity described in the bill of quantity is nominal quantity.

Cost overrun case 2

Variation order no 1 is made also similarly at date stated above in table 4.8, again the reason for variation was the break down during the amendment was not correct and the other issue was fixing of new rate for some items which was not included in contract agreement. Those items were:-

- Foundation trench excavation, gabion boxes, filter fabric, cut to spoil obtained from the intermediate excavation, buck filling using imported selected material and buck filling using imported selected granular material

Delays or Time Extensions

Total delay is 1605 calendar days compared to contract completion date. This prolongation was asked repeatedly by stating many reasons; from these problems the following are included.

1. During the amendment period of additional amount of 135,994,693.63 ETB was added to original contract amount, the time was also extended by negotiation to 1095 calendar days.
2. Time extension asked by ORCE at letter ref no IDO/ID/12919, date of 12/10/07 E.C 370 Calendar days by stating the following problems;

- Due to bad weather condition during two rainy seasons in the construction period.
- Shortage of fuel in the country market
- Delay of explosive because of shortage in the market
- Design problems

- Delay of requested payments for the executed and approved works has its own contribution for delay of projects.
- The right of way problems encountered during construction period.

The only evidence found during calculation of time extension was

- Time extension for work executed during construction period after amendment made was calculated as following, which was not logical.

  $\frac{41{,}608{,}130.18}{135{,}994{,}663.63} * 1095 = \underline{\underline{335.02}}$ Calendar days

While;

- 41,608,130.18 was variation work executed after amendment
- 1095 date given for amendment amount
- 135,994,663.63 amendment amount .

- Due shortage of fuel in the country at 10/12/2014 to 31/12/2014
- 21 calendar days, that was letter from oil Libya that I have got in file.
- Due to bad weather condition during two rainy season in the construction period was calculated as:

  30*2*0.20=$\underline{\underline{12}}$ calendar days
  Where did 20% they got? This calculation was also not logical.

3. The other time claim by ORCE was 510 calendar days by letter ref. no IDO/ID/4141, date 03/06/08 E.C, asked simply justified the problems, which was not supported by any evidence data. The proposed time extension was fully approved by letter ref no WDSE/2/2434 at 21/07/08.

- Rainy season closing of project during summer time
- Fuel shortage occurred in 2007 E.C
- delay of required payments for executed and approval payments
- shortage of budget allocated yearly for the project by client
- Design problems
- right of way problems

Quality of work related

1. Construction team performance related starting from the contract cost estimation the engineering report was completely ambiguous, relating to this two times addendum was made.
2. The supervision team was not to work properly on site the evidence show this are :

- Approval of request for specific fixing rate, without working break down of items and current market status they simply fix by taking the near project called as "kurbi-Qiwe road project" rate without considering site condition.
- During approval of variation asked by ORCE at letter ref IDO/ID/13021, date17/10/07 E.C amount of 154,762,795.72birr, the consultant write to client that the variation asked was not sufficient to complete the project and they requested to collect data and quantify. But, by letter DhDTHBO/BO-43-1/160 they wrote that the quantity was similar to quantity proposed by client. Finally about 80 million birr was extra amount estimation. This shows that design team of supervision again have no quality for estimation.
- They were late for approval of any document sent to them, client wrote letter shows their low efficiency by letter ref no WDSE/2/29118 at date 06/03/08 stated as "you didn't respond request by contractor for approval or comment on working template and working variation and gabion break down to fix unit rate within four months, so you will take all responsibility". This contributed also project delay.
- design problem was also big issue started from the begging of project the letter ref no WDSE/2/3603, date 30/09/03 from client to supervision team shows that there was no surveying primary data like
    - Bench mark on ground
    - No GPS points totally
    - No X-Y co-ordinates

1. The delay of project causes major defects within short period of time after completion, letter ref no IDO/2/671 at 11/12/09 by client to contractor stated as "the road is within the time of defects liability period of one year and it is your contractual responsibility to rectify the defects seen with in this period, the roads around Jarso and chinakson woradas at station of 54+200, 46+000, 47+000 is totally blocked by flood."

Case Study 2

2. Kercha-Shakisso project

Cost related data

Table 4.7: Cost related data for Kercha-Shakisso project

SN	Description	Amount (ETB)	Date agreement
1.	Main contract amount	367,400,678.80	30/09/2010
2.	Amendment no 1	318,222,660.85	23/04/2014

Total project cost including amendment value is **685,623,339.65** ETB.

- According to contract agreement the advance payment asked was 20% of total main contract amount **63,895,770.23** ETB, but the amount allocated was **4,400,000** ETB from finance and procurement work process at 25/04/03 with a reason of budget deficit.

Time related data

- Commencement date .....September 30, 2010
- Original completion date .....February 20, 2012
- Contract completion time.....790 calendar days
- Total completion date of the project will be.....2367 calendar days

Quality related data

- Designed by OWWDSE

Case study analysis 2

Kercha-Shakisso

Cost overruns

Total project cost overrun=685,623,339.61-318,222,660.85

=**367,400,678.80 ETB**

Reason for cost overruns

1. Amendment no 1 made between Oromia Roads Authority (ORA) and Oromia Roads Construction Enterprise (ORCE) through the presence of engineer from

Oromia Water Works Design and Supervise Enterprise (OWWDSE) as date indicated at table 4.9 was

- Due to discrepancy between the design of the road and the bill of quantity in the contract agreement
- The volume of work in the design is large as compared to that in bill of quantity.
- Missing of items also considered as a reason for variation.

Delays or Time Extensions

Total delay is **1577** calendar days compared to contract completion date. This prolongation was asked repeatedly by stating various reasons; the following reasons are included.

1. During the amendment period of additional amount of 318,222,660.85 ETB was added to original contract amount, the time was also extended by negotiation about **700** calendar days.
2. Time extension asked by ORCE at letter ref no IDO/ID/4697, date of 06/07/09 E.C 1095 Calendar days by stating the following problems;

- Due to adverse weather condition during construction period.
- Security problem to supply construction material
- Budget constraints.
- under estimation of all quantities
- Missing of activities and quantities without considering the actual site condition

The Oromia Roads Authority considering only security problems, an adverse weather condition and budget constraints and approved **877** calendar days.

There is no documented evidence for the above reasons during calculation of time extension.

Quality of work related

The document related to quality of work available was not enough to evaluate the practice of the project in this manner; however, we can conclude from the cost overruns and extreme time prolongation that there was no quality of preparation of condition of contract document and proper design for quantity estimation. The data related design was found that about design change of bridge. Bridge name is Kajowa River Bridge, which was ordered to design change because of;

- Earth work quantity of head work was high and decided by project engineer and project manager to change the centerline or alignment in order to be economical and safe.
- Bridge is height changed from 8m to 12m in order to increase water catchment,
- Abutment structure is also changed from masonry to concrete shear wall to increase the structural strength.

Case Study 3

3. Bege-Ketta project

Cost related data

Table 4.8 Cost related data for Bege-Ketta project

SN	Description	Amount (ETB)	Date agreement
1.	Main contract amount	137,448,416.41	09/10/2013
2.	Supplementary Agreement	209,737,054.30	08/08/2016

Total project cost after supplementary agreement is value of executed and material supplied 347,185,470.71ETB.

- According to contract agreement the advance payment asked was 27,489,683.28 ETB, and approved similar amounts at 11/04/06 with a disbursement of two schedules amount of 13,744,842.1ETB.

Time related data

- Commencement date.....October 09, 2013
- Completion date.....October 8, 2016
- Contract completion time.....1095calendar days
- Total completion date of the project will be .....1770 calendar days

Quality related data

- Designed by Classic Consulting Engineers Private limited company

Case Study Analysis 3
Bege-Ketta project Analysis

Cost overruns

Total project cost overrun=347,185,470.71-137,737,054.30

=**209,737,054.30 ETB**

Cost overrun case

Amendment no 1 made between Oromia Roads Authority (ORA) and Oromia Roads Construction Enterprise (ORCE) through the presence of engineer from Oromia Water Works Design and Supervise Enterprise (OWWDSE) as dated in table 4.10

- Due to discrepancy between the design of the road and the bill of quantity in the contract agreement
- The volume of work in the design is large as compared to that in bill of quantity for the item like common excavation; intermediate excavation and rock excavation are presented.
- Design problems also considered as a reason for variation.

Delays or Time Extensions

Time extension approved at 30-09-09 E.C was 675 calendar days and at this time the project exceeds the contract duration.

- The delay reason was due to supplementary agreement made.

Quality of work related

The document related to quality was not available; however, we can conclude from the cost overruns and extreme time prolongation that there was no quality of preparation of condition of contract document and proper design for quantity estimation. eg. Asking for design changes of pipe culvert about three stations was asked by ORCE as following.

- At letter ref. no PBK/130/2008 changing pipe length from 10m to 17m
- At letter ref. no PBK/131/2008 changing pipe length from 42m to 25m
- At letter ref. no PBK/132/2008 changing pipe length from 60m to 25m

The reason for changing of all pipe culverts is in adequate site information during design

Summary of case studies

Under this sub-topic how the project's cost overruns, time extended and poor quality of works were occurred and the measure taken was tried discussed in detail. Now the summaries of case studies are discussed below in short and clear manner.

The selected three projects of ORCE are exceed more than 100% of the original project cost and two of them exceeds more than 100% of contract duration and the left one is exceed about 62%.The project cost overrun was due to design problem, in accurate cost estimation, missing of items, in accurate quantity estimation and in adequate site information during contact document signing and bill of quantity estimation was the major reason. The measure taken during cost overruns was amendment, supplementary agreement and variation approval made to complete the project.

The most reason for time extension were bad weather condition, market fluctuation as a problem of supply, right of way problems, delay of payments and design related delay. According to assessment the measure taken to complete the project was extending the time requested by contractor without money compensation.

Quality related there is not enough data that used evidence for all projects.

CHAPTER FIVE
CONCLUSSION AND RECOMMENDATION

5.1. CONCLUSSION

1. In Oromia Roads Construction Enterprise most of construction professional workers are aware of the concept of project risk management while there is no formal risk management practice. The project risk management practice is different from project to project and low practice of clear documentation of risk areas and causes, which implies that starting from the planning to termination of the project, risk management under taken in the way that the project manager thinks best.

2. Project risk management in road construction project phase is highly important from conceptualization to termination of the project. However, planning and scheduling phase in construction project is ranked as highly important, followed by conceptualization and contract signing phase, while execution or construction stage is the implementation of risk management comes after in Oromia Roads Construction Enterprise. Finally termination of construction project is the phase at project risk management is not more important.

3. The methods and techniques mostly used in ORCE road projects to identify, asses, allocate and mitigate the project risks are highly dependent on an individual's judgment and past experience. In most projects, there is no specialized risk management team and no experts in all projects to deal with different risks that might arise during the life-cycle of the projects.

4. To study the effect of different areas and causes of risks in meeting project objectives in ORCE, risk ranking matrix is used for categorizing the risk as minor, moderate or major and decides on the action to be taken. Minor risks can be accepted, moderate risks need some management measures and for major risks with high probability of occurrence and high impact a serious risk action schedule needs to be devised in Oromia Roads Construction Enterprise, The most but not restricted high risk areas revealed during assessment are in adequate site information, right of way problems, poor documentation system of risks, slow site hand over and design error and omissions.

5.2. RECOMMENDATION

1. In Oromia Roads Construction Enterprise formal project risk management needs to be established.

2. Establishing risk management team through regular training, continuous seminars and workshops, formal risk documentation and provide work for risk expert is also need to be highly practiced in order to deal with different risk areas that might arise during the life-cycle of the projects.

3. A systematic risk ranking matrix of different areas and causes of project risks for every individual construction projects needs to be analyzed, in order to identify project risk with high likelihood and high impact to manage and understand effectively on project performance.

4. Construction related risk area and project management related risk areas have the highest impact on Project objectives in Oromia Roads Construction Enterprise and need a series attention.

5. Detail studies and risk assessment in every project should be implemented; in order to meet project objectives.

REFERENCES

1. Abraham, A. (2008). Time-Cost relationship for public roads construction projects in Ethiopia; MSc Thesis, Addis Ababa Institute of technology, Ethiopia.
2. Addis, M. (2014). A Study on Construction Contract Risk Management Practices in Ethiopian Building Construction Projects; MSc thesis, Addis Ababa Institute of technology, Ethiopia.
3. Anthony, M. (2014). A systematic Approach to Risk Management for Construction.
4. CDC. (2006). Unified Process guide ;{ accessed November, 26th, 2017}, www2.cdc.gov/cdcup/library/matrix/default.htm
5. Chapman, C. & Wards, S. (2004). Why risk efficiency is key aspect of best practice projects; *International Journal of Project Management*.
6. Chris, Ch. & Stephen, W. (2003). Project Risk Management process, Technique and Insight, School of management; university of Southampton, UK.
7. CPMHB. (2007).Construction Project Management Hand Book; Revision 1.
8. Dennis, L. (2004). Project management in construction; Gower, Britain.
9. Dey, P. K. (2010). Managing project risk using combined analytic hierarchy process and risk map; *Applied Soft Computing*.
10. Emeritus, C.A O'Flaherty. (2002).The location, Design, Construction &Maintenance of pavement; fourth edition.
11. Fred, L. Mannering, Scott, S. Washburn (2012). Principles of Highway Engineering and Traffic Analysis; fifth edition.
12. Fredrick, S. Merritt, Jonathan T. Ricketts (2011) .Building Design & construction management hand book; sixth edition, New York.
13. Gene U.M. (2015). Construction Management Lecture Note; AASTU,
14. Getachew, T. (2009). Design Risk Management in Ethiopian federal Road Projects; MSc thesis, Addis Ababa Institute of technology Ethiopia.
15. Godfrey, P. (1996). Control of Risk; A Guide to the systematic Management of Risk from construction industry research and formation, London.
16. Hartman, F. and Soelgrove, P. (1996). Risk Allocation in Lump-Sum Contracts; Concept of Latent Dispute, *Journal of Construction Engineering and Management*.
17. IRM. (2002). A Risk management Standard; UK.
18. James, P. Bobotek. (2011). Construction Risk Management: Ten Issues in Construction Contracts, Perspectives on Insurance Recovery; Newsletter – summer

19. Jason, W. (2006). The Project Management Life Cycle; Cambridge University, UK.
20. Jayasudha, K. and Vidivelli, B. (2016). Analysis of Major Risks in Construction Projects; *ARPN journal of Engineering and Applied Science*.
21. Lawrence, F. B. (2003). The Management of Construction: A Project Life Cycle Approach; University of Alaska, Fair banks.
22. Macdonald, C. C. (2001). Allocation of Risk in Major Infrastructure Projects.
23. Mahamid, I. (2014). Contractors' perception of risk factors affecting cost overrun in building projects in Palestine; *the IES Journal Part A, Civil & Structural Engineering*.
24. Nael, G.B. (2003). Risk and Insurance in Construction; second edition, London and New York.
25. Nasirzadeh, *et al* (2008). System dynamics approach for construction risk analysis; *International Journal of Civil Engineering*.
26. ORCE. (2017). Oromia Roads Construction Enterprise; profile document.
27. PMI. (2000). A Guide to the Project Management Body of Knowledge; Project Management Institute standard committee.
28. PMI. (2004). A Guide to the Project Management Body of Knowledge; Project Management Institute standard committee.
29. PMI. (2008). A Guide to the Project Management Body of Knowledge. Project Management Institute Standards committee.
30. PMBOK. (2013).Construction Extension to A Guide to the Project Management Body of Knowledge. Project Management Institute.
31. PPA. (2011). Policy of Public procurement agency; (International Competitive BiddingsICB).
32. PRMHB. (2003). Project Risk Management Hand Book; first edition, California.
33. Richard, T. & Bent, T. (2004). Road Engineering for development; second edition.
34. Stefano, T. (2008). Industrial project management; university of Udine, Italy.
35. Tesfaye, G. (2016). Dynamic Risk Modeling and Analysis in Addis Ababa Road Construction Projects; MSC thesis, Addis Ababa Institute of technology Ethiopia.
36. Twort, A. C & Gordon Rees, J. (2004). Civil Engineering Project Management; fourth edition, Elsevier's Science & Technology Rights Department in Oxford, UK.
37. Zewudu, T.W. (2012). Rights, Obligations & Remedial Rights of the Main Contractor, engineers, employer and environmental protection manual; Addis Ababa University, Ethiopia.

APPENDICES

APPENDEX A: QUESTIONNAIRE SURVEY

GRADUATE PROGRAM

SCHOOL OF ARCHITECTURE AND CIVIL ENNGINEERING

DEPARTMENT OF CONSTRUCTION TECHNOLOGY & MANAGEMENT

QUESTIONNAIRE SURVEY FOR INDEPENDENT ON

Project Risk Management Practice of Oromia Roads Construction Enterprise

My name is Teshome Demisse and I am currently working on masters of Engineering Independent project for the partial fulfilment of the MENG degree in Construction Technology and Management at Addis Ababa Science and Technology University (AASTU).

The aim of this questionnaire is to study the project risk management practice in Oromia Roads Construction Enterprise (ORCE), Please Attempt to answer all questions. All the information gathered will be kept strictly confidential and will be used only for academic research and analysis without mentioning the names of individuals involved.

Thank you in advancing for your time and Kind Corporation.

Yours faithful,

Teshome Demisse Guta

Mobile: - +251-910-119-837 or

+251-912-683-006

Email: - teshedemisse@yahoo.com

Section 1:-General Information

1. Name of respondent_____.
2. Organization _____.
3. Profession or job title_____.
4. Areas or departments of working , Please put (X) symbol in a given box

☐ contract head office	☐ Construction head office	☐ project	☐ others

5. Experience of workers ranges, Please put (X) symbol in a given box

Year of experience in Oromia Roads construction Enterprise (yrs)
☐ 0-5
☐ 6-10
☐ 11-15
☐ above 15

- How many years have you worked in another construction sector_____?

6. Educational status, Please put (X) symbol in a given box

☐ Diploma	☐ BSC	☐ MSC/MENG	☐ PHD	☐ Other

I. **PART ONE: - Questionnaires on awareness and formal practice of project risk management.**

1.1. Do you have awareness of project risk management practice in road construction projects?

☐ Yes ☐ No

1.2. Do you have a formal project risk management techniques or practice in your construction sector or projects?

☐ Yes ☐ No

1.3. Do you think that Project risk allocation is fair in your organization?

☐ Yes ☐ No

1.4. There are aspects of monitoring and controlling the works in construction projects , please rank by putting (1,2,3) in the given box as more practiced in your construction projects or sector. Aspects are related to time, cost and quality, ranking should be actual practice to minimize adverse impacts of risks.

☐ Actual schedule program compared against project schedule during construction phase always.

☐ The cost status checked to establish how actual performance compares with budget thoroughly.

☐ Quality management, to assure that the work complies with the technical requirements.

1.5. Documentation is a by-product of risk management and one of the formal process of risk management technique, here there are points to formal documentation processes, so please select by putting (X) which one does your construction project applies. You can select more than one if you think actually practiced in your sector/project.

☐ At working site clearly documentation what people thinking.

☐ Clear communications between workers to write risks

☐ Familiarization new staffs to document risk causes

☐ Using documents for risk claims

☐ A proper, knowledge based and systematic data acquisition system is applied

II. **PART TWO: - Questionnaires for ranking of project risk management practice and assessment of cause and effects of construction risks.**

2.1. Please rank the importance of risk management during the construction phases?

(As 1=very low, 2=low, 3=moderate, 4=high, 5=very high)

S.N	Project construction phases	Importance of risk management				
		1	2	3	4	5
1.	Conceptualization and contract signing					
2.	Planning and scheduling					
3.	Execution or construction					
4.	Termination					

2.2. Which areas of risks, do you think, affects project objectives? Please rank the impact depending up on the following table, check each of risk areas for time impact, cost impact and quality impacts. put (**X**) (As 1=low, 2=moderate, 3=high)

SN	Risk areas	Risk Impacts								
		Cost related			Time related			Quality related		
		1	2	3	1	2	3	1	2	3
1	Natural related									
2	Physical related									
3	Financial related									
4	Political and Environmental related									
5	Design related									
6	Construction related									
7	Contractual related									
8	Project management related									
9	Others									

2.3. In the following table construction related risk areas are categorized accordingly, please put(X) appropriately in the box of probability of occurrence and impacts. While probability of occurrence frequency is justified as low, moderate and high for rank, impacts of time, cost and quality is also similarly low, moderate and high for rank.

SN	Construction Related Risk Areas	Probability of Occurrence			Impacts								
					Cost related			Time related			Quality related		
		High	Moderate	Low	High	Moderate	Low	High	Moderate	Low	High	Moderate	Low
	A. Natural related risks (acts of God)												
1.	Un expected flood												
2.	Un expected land slides												
3.	Ceasing of works due to rain												
	B. Physical Related risks												
1.	Frequent of damage Equipment												
2.	Labour injuries at construction site												
3.	Theft of construction materials												
4.	Shortage of plant and equipment												
5.	Un skilled labour for equipment maintenance												
	C. Financial and Economic												
1.	Financial inflation												
2.	Funding changes for fiscal year from client												
3.	Shortage of internal financial cash flow												
	D. Political and Environmental risks												
1.	Changes of rules and regulation												
2.	Requirements for permits of construction material and site camp, etc												
3.	The influence of law and order												
4.	Pollution and environmental safety												
5.	Priorities change on existing program												
6.	New stakeholders emerge and demand new work												
7.	Change in scope of work												
	E. Design related risks												
1.	Incomplete working design												
2.	Defective design												
3.	Design error and omissions												
4.	Design changes												
	F. Construction Related												
1.	Labour disputes												
2.	Labour productivity												
3.	Un expected different site condition												
4.	workers Lack of experience												
5.	Poor productivity of plant and equipment												
6.	Improper construction methods												
7.	Errors during construction												
8.	Inappropriate intervention by client												

9.	Client choose time and cost over quality												
10.	Right of way problems												
11.	Influential stake holders need their satisfaction												
12.	Insufficient time to plan risks												
	G. Contractual related risks												
1.	In adequate site information												
2.	Inaccurate contract time estimation												
3.	Inaccurate work break downs												
4.	Slow site hand over												
5.	In accurate cost estimation												
6.	Missing of items in condition of contract documents												
7.	Limitation of specification in condition of contract												
8.	Ambiguity of risk in condition of contract												
	H. Project Management related risks												
1.	Project purpose and need is poorly defined												
2.	Project scope definition is poor or incomplete for management												
3.	The number of projects affect to control												
4.	Improper quality control and testing methods												
5.	Estimating or scheduling errors												
6.	Miscommunication between project team												
7.	Pressure to deliver project on an accelerated schedule												
8.	Lack of upper management support												
9.	Lack of resource availability												
10.	Influence local agency issues												
11.	Negative Public awareness or support about project												
12.	Poor Documentation system of risks												
13.	Internal bureaucracy problems												

III. **PART THREE:- Open Questions**

1. What methods do you use in your construction project to deal with risk management?

_____
_____
_____
_____
_____

2. Which party do you think highly responsible for project risk management in roads construction?

_____
_____
_____
_____
_____

3. Does risk allocation under condition of contract document for your company is best position for management? If not what you recommend, please put example.

_____
_____
_____
_____

4. What do you recommend about project risk management in order to overcome project cost overruns, delays and poor quality and meet project objective?

_____
_____
_____
_____

5. How do you mitigate project risks and put your response method clearly please.

_____
_____